AVIATION WEEK

A McGRAW-HILL PUBLICATION

DEC. 22, 1952

50 CENTS

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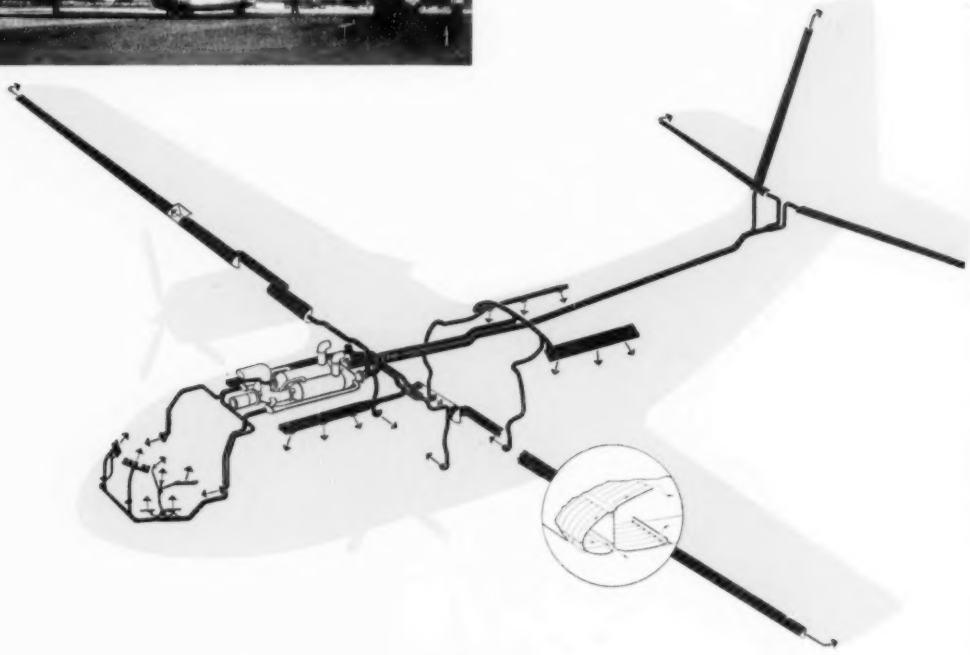

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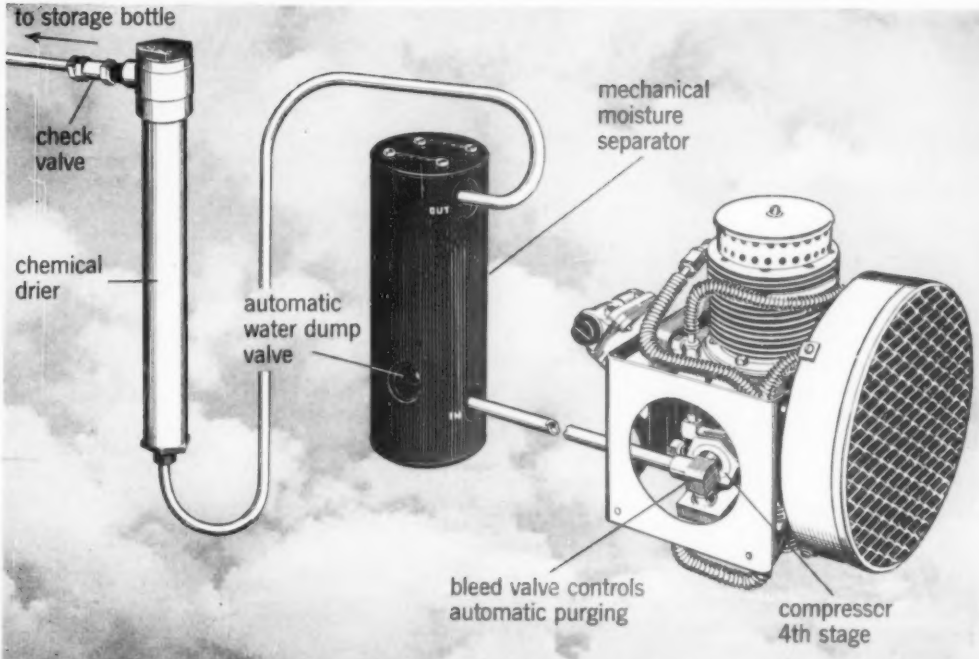

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Kidde dehydration equipment, through processes of separation and drying, delivers compressed air to the storage bottles with a free air dew point of at least minus 65° F. Saturated air going into the compressor is 99.6% dry when it reaches the storage bottles. The accumulated moisture is released by automatic dump valves. When this happens the entire system from compressor to check valve is purged.

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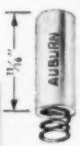

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Aviation Week

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EDITOR

Merlin H. Mickel
MANAGING EDITOR

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Henry Lefer.....News Desk
Victoria Giaculli.....Editorial Makeup
Leo T. Tarpey.....Printing & Production
Helen Rich.....Editorial Research

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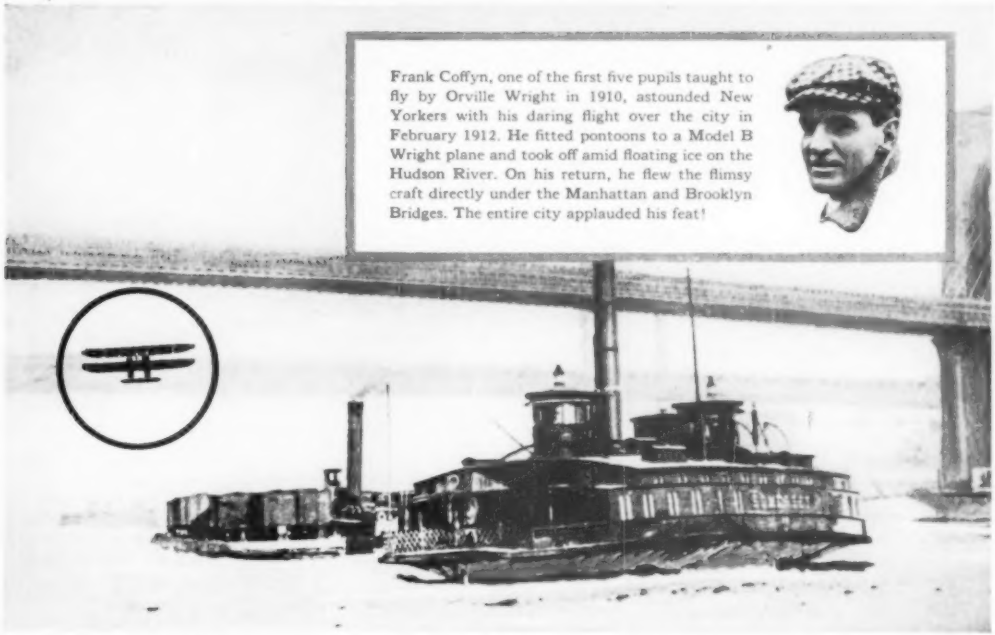
Frank Coffyn thrills New York—1912



Frank Coffyn, one of the first five pupils taught to fly by Orville Wright in 1910, astounded New Yorkers with his daring flight over the city in February 1912. He fitted pontoons to a Model B Wright plane and took off amid floating ice on the Hudson River. On his return, he flew the flimsy craft directly under the Manhattan and Brooklyn Bridges. The entire city applauded his feat!

FORTY YEARS LATER. Today Frank Coffyn still takes an active interest in aviation. A member of Hiller Helicopters' staff, he is shown here (left) seated with Stanley Hiller, Jr. in one of the firm's "360" helicopters.

The pages of aviation history are filled with remarkable exploits of adventure and research, experiments which helped pave the way for aviation's pre-eminent position in the world today!

Another phase of aviation research—that pertaining to fuels and lubricants—has also contributed much to aviation's growth! Phillips Petroleum Company has played an important part in this development. Today, Phillips is one of the country's largest suppliers of aviation fuels for commercial and military use. In addition to a tremendous capacity for supplying 115/145 grade aviation gasoline, Phillips is always ready with the very latest fuels for turbo-props and jets.

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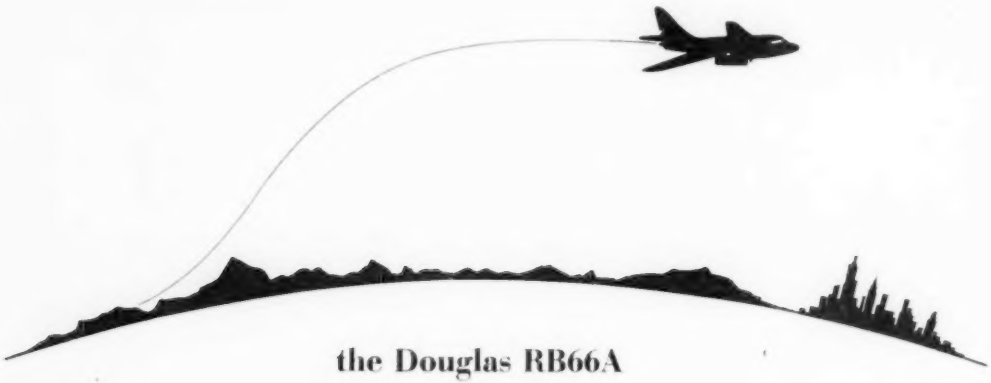
AVIATION PRODUCTS

U.S. Air Force's new twin jet reconnaissance aircraft

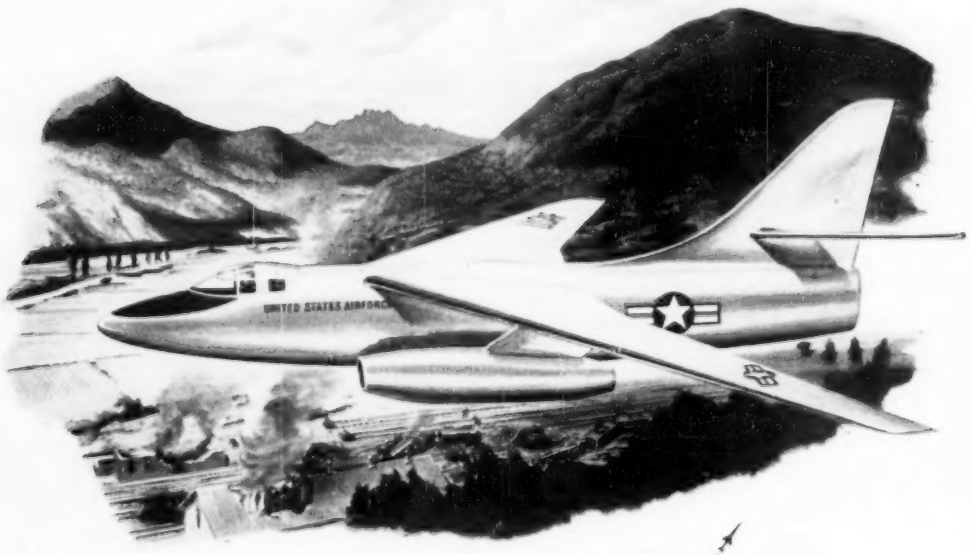


the Douglas RB66A

Built to perform in the stratosphere, or to scrape treetops in low-level missions, the new U.S. Air Force RB66A will be one of the most versatile photo-reconnaissance planes ever designed.

Complete performance data must still remain secret, but the Air Force permits release of the information that the Douglas RB66A will be in the 600 to 700 mph class—with range enough to fly deep into enemy territory, and return. Powered by twin jets, slung in pods below the wing outboard of the fuselage, RB66A will carry the most modern photographic equipment, for accurate reports on operations.

Design of RB66A is another example of Douglas leadership in aviation. Planes that can be produced in quantity to fly *further and faster with a bigger payload* is a basic concept at Douglas.



Depend on *DOUGLAS* First in Aviation

NEWS DIGEST

Domestic

A Trans World Airlines Super Constellation was damaged when it made an emergency night landing at the Fallon, Nevada, Naval Air Station, 70 mi. from Reno Dec. 7. No. 3 and 4 engines had failed. Plane veered off the runway, collapsed the right main landing gear and damaged the wing tip. None of the 39 passengers or five crew members on the New York-San Francisco flight was injured. Cause of the engine failures was not given.

Rufus T. Amis, Jr., president of Aero Design & Engineering Co., Bethany, Okla., has been elected chairman and to the board of governors of the Utility Airplane Council of the Aircraft Industries Assn. for 1953. He succeeds C. F. B. Roth, president of Aircooled Motors, Inc., Syracuse, N. Y., in both positions.

McDonnell Aircraft Corp. last week named Kendall Perkins, vice president, engineering, to the board of directors and the executive committee. C. Warren Drake, vice president, manufacturing, and already a board member, was elected to the executive committee. President James S. McDonnell, Jr., and Robert H. Charles, vice president, contracts, are the other members of the executive committee. Now vice presidents are Garrett C. Covington, airplane chief engineer; William A. Roth, factory manager; William R. Orthwein, Jr., manager of personnel and public relations, and John F. Aldridge, Jr., manager of sales and service. Executive committee shifts were simultaneous with announcement of the resignation of Don Berlin as vice president-general manager, to become president of Piasecki Helicopter Corp. He replaces C. Hart Miller who remains as Piasecki executive vice president-general manager.

Martin Viking 9 rocket attained 135-mi. altitude during Navy firing at White Sands Proving Grounds, N. M. The 7¼-ton rocket achieved a speed of 3,900 mph.

American Airlines has awarded a large contract to Burns Aero Seat Co., Burbank, Calif., for aircoach seats for 80-passenger DC-6s. Conversion will allow American to double its scheduled transcontinental tourist service by early spring of 1953.

Republic Aviation Corp. has passed the $100-million point in annual wages, said to be the first time a Long Island, N. Y., firm has reached this mark.

DE HAVILLAND DOVE demonstrator belonging to Pacific Airmotive Corp., Linden, N. J., which crashed Dec. 9 near Staten Island Airport, N. Y., killing pilot and co-pilot and injuring two PAC officials. The plane was being demonstrated to Avco Mfg. Co.'s chief pilot. Cause of the crash is undetermined, but early reports indicated no aircraft or engine malfunctioning. Cabin remained relatively intact.

Aviation Distributors and Manufacturers Assn. new officers elected this month at Miami include L. W. Trees, Scintilla Magneto division, Bendix Aviation Corp., Sidney, N. Y., president; Lawrence F. Zygmunt, General Aircraft Sup. Corp., Detroit, and James Riddle, National Aeronautical Corp., Ambler, Pa., vice presidents.

Detroit Harvester Co. has purchased all assets of Clinton Machine Co.'s Warner division, one of the largest manufacturers of aircraft and ordnance hydraulics, for cash "in excess of a million dollars."

Keel of USS Saratoga, (CVA 60), the Navy's second super carrier, was laid at the Brooklyn Navy Yard. Cost of the carrier is estimated at $209,700,000. Navy eventually plans to build 10 super carriers and tentatively plans to use atomic power to propel the fourth in the series.

First production FJ-2 Fury, sweptwing North American jet fighter, has been accepted by the Navy for carrier duty.

Financial

Trans World Airlines reports that at recent offering of common stock to stockholders, the firm sold 353,822 shares at $16 a share for a total of $5,661,152. TWA will not issue the 28,094 shares offered but not purchased.

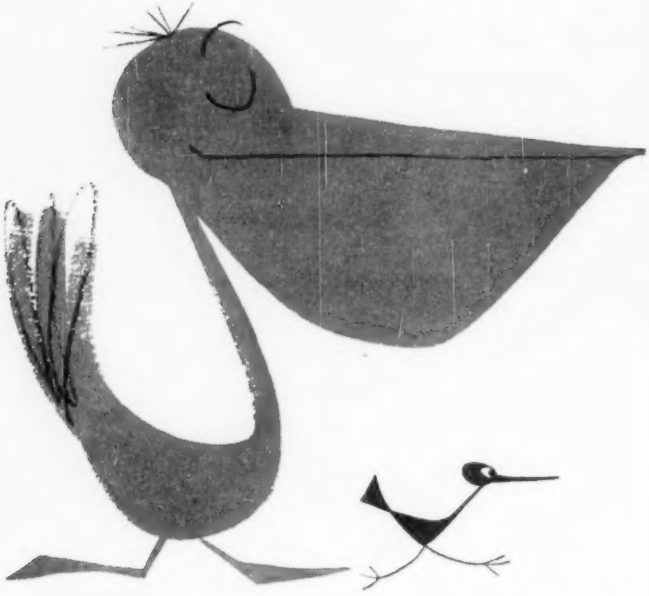
Aeroquip Corp. reports net earnings of $923,492 for year ended Sept. 30. A total of $173,438 was paid in dividends during fiscal 1952, and a year-end extra of 2½ cents per common share also was paid. Regular 7½-cent quarterly dividend has been declared since Oct. 1. On that date backlog amounted to $12 million.

General Dynamics Corp. has paid a last quarter dividend of 75 cents a share. Net sales for the firm and its subsidiary, Canadair Ltd., amounted to over $110 million during 1952. Backlog of the organization has been estimated at $385 million.

International

Society of British Aircraft Constructors anticipates a temporary layoff of about 2,500 workers in the British aircraft industry followed by an increase of 10,000 workers during 1953. Until recently announced production cutbacks of obsolescing types, the British aircraft industry has been growing at a rate of about 2,500 workers a month during the past year.

Japan will start negotiations soon on civil air pacts with Sweden, Denmark, Norway, The Netherlands and France, according to Nippon Times. An air agreement has been reached with the U. S. and a pact with the U.K. will be signed soon.



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3H SAFETY CLAMPS

AVIATION CALENDAR

Jan. 8-9—Symposium on Industrial Application of Automatic Computing Equipment, sponsored by Midwest Research Institute, Hotel President, Kansas City, Mo.

Jan. 12-16—Annual meeting and engineering display of Society of Automotive Engineers, Sheraton-Cadillac Hotel, Detroit.

Jan. 14-16—AIEE-IRE-NBS Conference on High Frequency Measurements, Statler Hotel, Washington, D. C.

Jan. 15-16—Fifth Illinois Custom Spray Operators Training School, University of Illinois, Urbana, Ill.

Jan. 19-23—Plant Maintenance Conference, Public Auditorium, Cleveland, O.

Jan. 19-23—Winter general meeting of the American Institute of Electrical Engineers, Hotel Statler, New York, N. Y.

Feb. 12-13—National Aviation Education Council annual meeting, Atlantic City, N. J.

Feb. 18—New York Section of the Instrument Society of America, Hotel Statler, New York, N. Y.

Feb. 18-19—Eighth Annual Society of the Plastics Industry, Reinforced Plastics division, conference, Shoreham Hotel, Washington, D. C.

Mar. 10-11—Eleventh Annual Conference, Society of the Plastics Industry Canada, Inc., General Brock Hotel, Niagara Falls, Canada.

Mar. 25-27—National Production Forum of the SAE, Hotel Statler, Cleveland, O.

Mar. 31-Apr. 2—First International Magnesium Exposition, National Guard Armory, Washington, D. C.

Apr. 4-12—Second Annual International Motor Sports Shows, Grand Central Palace, New York, N. Y.

Apr. 20-23—Aeronautic Production Forum, National Aeronautic Meeting and Aircraft Engineering Display (SAE), Hotel Governor Clinton and Hotel Statler, New York, N. Y.

May 11-13—IRE National Conference on Airborne Electronics, Dayton Biltmore Hotel, Dayton, O.

May 18-22—Fifth National Materials Handling Exposition, Convention Hall, Philadelphia.

June 9-11—Second International Aviation Trade Show, Hotel Statler, New York, N. Y.

Sept. 7-13—1953 SBAC Coronation Year Flying Display, Farnborough, Hampshire.

Sept. 14-17—Fourth Anglo-American Aeronautical Conference, London.

Oct. 10—International Air Race, England to Christchurch, N. Z., entry deadline Jan. 31.

PICTURE CREDITS

7—Wide World; 9—(top) USN; (center) Boeing Airplane Co.; (bottom) Hawker Siddeley; 14—NACA; 17—American Airlines; 21—Curtiss-Wright Corp.; 24—(top) General Electric; (bottom) Landis Tool Co.; 29—Fairchild Engine & Airplane Corp.; 34—Aeroquip Corp.; 62—CAA; 68—American Airlines.

DOUGLAS XA3D-1 FIRST FLIGHT—Here is the first actual photo of Navy's new heavy attack plane taken during its first flight at Edwards AFB, Calif. Prototype is powered by two Westinghouse J40s slung under the wings in pods, but production models will have P&WA J57s. Gross weight is about 70,000 lb. and top speed is in the "600-700-mph. class." Bulge atop tail houses anti-spin chute.

BOEING KC-97F ALOFT—The latest model Stratofreighter (left) complete with Flying Boom tucked under its tail. Now in production for USAF's Strategic Air Command, the P&WA R4360-powered KC-97F also can carry personnel, cargo, patients and handle air resupply.

Military Planes Show Their Stuff

HUNTER WITH SAPPHIRE—Flight tests have been started on the new Armstrong Siddeley Sapphire-powered Hawker Hunter F.2 jet interceptor (below). RAF has ordered this new version into production on a super-priority basis, as it did the earlier Rolls-Royce Avon-powered Hunter F.1. The more powerful Sapphire engine will make the new model even faster than the F.1, which is classed in the supersonic category.

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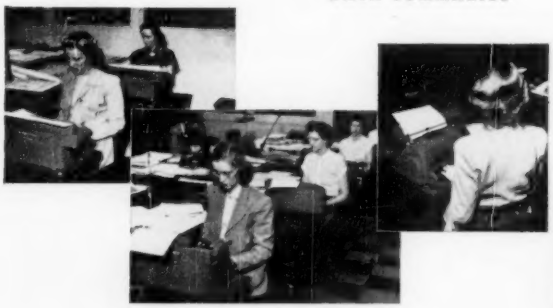

Remington Electri-conomy Typewriters at work at the Glenn L. Martin Co.

Remington Rand INC THE FIRST NAME IN TYPEWRITERS

WHO'S WHERE

In the Front Office

J. V. Naish has been elected executive vice president of Consolidated Vultee Aircraft Corp., San Diego. He previously was vice president for sales and contracts at Convair, which position has been given to **J. G. Zevely.**

Donald G. Rover has been appointed assistant to the president of Slick Airways, Inc., where he will negotiate gasoline and freight drayage contracts in addition to administrative duties.

Col. B. L. Anderson, vice president of Philippine Air Lines, has been elected a member of the board of directors. In addition four new vice presidents have been named: **C. M. Biondi,** general traffic and sales manager and European regional director; **Col. Walter L. Hurd, Jr.,** general operations manager; **Rafael Ygoa,** treasurer; **Daniel M. Gomez,** secretary. Other new appointments were **Juan de Ibazeta** as comptroller and **Capt. Elfren Abad Santos** as general industrial relations manager. **Col. Lee A. Telesco** has been named administrative assistant to Col. Anderson.

Changes

Harry E. LeRoy has been named director of manufacturing for Aviation Engineering Corp., L. I., N. Y.

Robert S. Kinsey has been named manager of industrial engineering and planning for Wright Aeronautical division, Curtiss-Wright Corp., Wood-Ridge, N. J., a newly created position. **Kenneth Mehlhof,** public relations manager for Wright Aeronautical, is leaving to accept a position in the advertising field in New York.

Helmut Schelp has been assigned to investigate and screen new products for manufacture for AiResearch Manufacturing Co., Los Angeles. **W. T. von der Nuell** has been appointed senior project engineer at AiResearch.

Barton Tyler has been named executive assistant to the administrative head of Northrop Aircraft's Special Weapons division, Hawthorne, Calif.

Allen W. (Skip) Walz is new executive staff assistant to vice president-engineering of Arma Corp., N. Y.

Ferd Gillig has been appointed head of Ethyl Corp.'s new aeronautical section.

Albert E. Namey has been named chief engineer of the Test Equipment Design Department at the Tucson plant of Bendix Radio division, Bendix Aviation Corp. and **Norman Caplan** is new chief engineer of the Military Communications and Navigation Engineering Dept. of Bendix Radio.

Edward N. Townsend has been designated superintendent of supply and controls at Lockheed Aircraft service-international, N. Y. and **Mark J. Maidel** has been named production superintendent.

Kenneth F. Leaman has been appointed assistant division manager and general works manager of Grand Central Aircraft Co., Tucson, Ariz.

INDUSTRY OBSERVER

► USAF is getting ready to award a development contract for a lightweight "stripped-down" interceptor (AVIATION WEEK Oct. 13, p. 11) with North American Aviation, Inc., most likely to get the job. Lockheed and Northrop also are in the competition.

► Convair's supersonic bomber, for which USAF is readying a production contract (Aviation Week Oct. 8, p. 11), is known as the "Hustler" within the company and had been given the designation XB-58 by Air Force during the design study phase. It is likely that new USAF designation will be assigned to the production version to be built at Convair's Ft. Worth plant.

► Another accident has delayed flight testing of the crescent-wing Handley Page H.P.80 bomber, according to industry observers recently returned from England. Fire during hydraulic fluid draining operations killed one mechanic, injured several others, severely damaged the bomber's nose and ruined the cockpit. Previously, the H.P.80 landing gear collapsed just before initial flight tests and kept it out of the Farnborough SBAC show. The fire is expected to delay flight testing for at least three months. The H.P. 80 bomber also is expected to serve as a prototype for the H.P.97 jet transport (AVIATION WEEK Sept. 29, p. 15).

► Wording of the latest military agreement on the Army's integral aviation may mean future trouble for manufacturers now developing convertiplanes for use by the Ground Forces. Industry observers are wondering why the memo (Aviation Week Sept. 29, p. 14) refers to "rotary wing type aircraft, the total lift and propulsion of which are achieved solely from rotors." This theoretically would eliminate hybrid aircraft using jet engines for forward thrust and designs which would utilize stub wings for lift.

► Allison division of General Motors Corp. notes that jet engines built in its Indianapolis plant have now logged over 2 million hr. of flight time. This is just about twice as much jet operations as claimed by Rolls-Royce, Ltd., largest British jet engine manufacturer.

► United Air Lines has given RCA a short-term airborne radar study and development contract aimed at eventual use of radar for terrain clearance and storm warnings. Under the program, RCA, which now builds the AN/APS-42 transport radar for the military services, will seek methods of improving reliability, reducing complexity and cost and adapting equipment for airline flight operations.

► Big problem in the fast approaching era of heavy press operations for aircraft manufacture is how to reduce the machining required for finishing certain areas of large forgings. Airframe manufacturers would like to get these large parts off the press as "precision forgings"; little further machining would be required before actual use. Estimates on machining cost of these parts runs from $20 to $200 for each pound of weight removed. Another problem is the distortion induced in large forgings during machining operations.

► Pratt & Whitney Aircraft's general manager, Bill Gwinn, recently noted a sore spot that has troubled U. S. manufacturers trying to build jet engines of British design. British thrust ratings are based on the average output of engines coming off the production line with as much as 4% allowance below the guaranteed rating still acceptable for delivery. U. S. ratings are a minimum guarantee and every engine accepted must deliver rated power. According to British standards, a jet rated at 5,000 lb. static thrust could deliver only 4,800 lb. and still be accepted. According to U. S. standards, every engine that did not deliver guaranteed rating of 5,000 lb. thrust would be rejected. Thus, on a standard production line operation involving engines of the same rated thrust, U. S. manufacturers are building engines which are more powerful than their British counterparts.

Washington Roundup

OSD: Still Mushrooming

Office of Secretary of Defense, since it was created under the 1947 Unification Act to cut down military cost, has mushroomed from a $3-million-a-year operation to a $14-million-a-year operation, and is still growing. OSD doesn't think $14 million is enough, asked $15 million for the current year, but Congress trimmed the request.

Although funds for aircraft and other weapons were held down during the pre-Korean years of defense economizing, OSD has grown steadily year by year. OSD employment was 542 in the fiscal year 1948, soon will be up to around 2,000—almost a four-fold growth.

Overall OSD includes the staff directly under the Secretary of Defense, plus the staffs of the Joint Chiefs of Staff, Munitions Board and Research and Development Board.

- Biggest boom has been in Munitions Board, overseer of production and procurement, which in five years has developed more than seven-fold, from an $812,000-a-year operation to a $6-million operation.
- Secretary of Defense's direct staff has grown from a $934,000-a-year operation to $4.6 million, more than a four-fold increase.
- Cost of Joint Chiefs of Staff organization has gone from $557,000 to $1.6 million a year.
- Most modest increase is in Research and Development Board, which has developed from $1-million-a-year to a $1.8-million-a-year operation.

Research and Development

Although plane procurement orders will start to taper off in 1954, the upward trend in Air Force and Naval Air contracting for research and development projects is expected to continue indefinitely. This is in line with the decision to put emphasis on technological advancement instead of weapons stockpiling.

Both USAF and Naval Air are well along on obligating this year's research and development funds—about 75% of which is in industry contracts.

- USAF obligated more than $193.5 million of its research and development funds in the July-to-November period, an average of $48.8 million a month.
- Naval Air obligated $65.8 million in the period, an average of $16.4 million a month.
- Unless USAF and Navy let up slightly on their rate of obligating for the first four months of fiscal 1953, they will run out of funds to commit before the end of the year, July 1.
- For the remaining months of fiscal 1952, USAF has $377 million and Navy more than $110 million to obligate for research and development.

But USAF's and Naval Air's pockets are bulging with unspent cash earmarked for research and development projects already underway. The total: about $1.4 billion.

Korean Record

For the period from the start of the Korean war June 26, 1950, to December 1952, the services give this report on aerial performance:

- **Air Force:** 548,400 combat sorties.
- **Naval Air, including Marine aviation:** 203,008 combat sorties.
- **The allocation of effort:** USAF 63%; Naval Air, 37%. This requires some adjustment in favor of the Navy, since the Naval sorties do not include observational or helicopter flights and USAF sorties include all missions beyond the front line.

Patterson Backtrack

Air Transport Assn. gracefully slapped down W. A. Patterson's suggestion that Interstate Commerce Commission be given authority over air transport regulation.

The United Air Lines president's proposal:

"We should re-examine the recommendation . . . that the Interstate Commerce Commission coordinate the activities of the various regulatory agencies, act as moderator, coordinator, and court of appeals."

But ATA, a few days later, unanimously voted a reaffirmation of its long-standing position in favor of an independent Civil Aeronautics Board. Apparently in a gesture to Patterson, however, the association tacked on a clause stating its willingness to examine or re-examine any proposal for a different organization. Patterson went along.

Local service lines particularly are adamant in favor of an independent board. James Ray, Washington representative of several local lines commented: "Young airlines particularly would be smothered under ICC regulation. If air transport had been under ICC in 1947, there wouldn't be any local carriers."

Nonskeds, perennial complainers that CAB is "dominated by the scheduled airlines," nevertheless are squarely behind the independent agency organization for air commerce regulation and do not want it lumped in with surface regulation.

People

Sinclair Weeks, successful businessman slated to become the new Secretary of Commerce, is expected to clamp down on federal support for airports, airways facilities and other public works. During his brief service in the Senate (1944) under appointment, Weeks urged: strong defense, including air power; warned against postwar disarming, and attacked proposed postwar outlays for public works such as airports. He observed at the time: "You can have state socialism or free enterprise but cannot indefinitely have a mixture of the two."

Walter Williams, designated to become the new Undersecretary of Commerce, is a protege of United Air Lines' director Paul Hoffman. He followed Hoffman as head of the Committee for Economic Development and later joined Hoffman in pushing Eisenhower for the Republican nomination. He was defeated for the Washington Senate seat by Sen. Warren Magnuson in 1950, but made a remarkable showing for a political newcomer.

Sen. Alexander Wiley, top-ranking Republican on Senate Judiciary Committee, wants to start off the year with an investigation to ascertain whether political influence has figured in the Democratic Administration appointment of officials to high-salaried positions in firms seized during World War II. General Aniline Film and Dye Corp., headed by Jack Frye, former TWA president, is the top firm on Wiley's list. Among the directors of the firm appointed by the Democratic Administration: Sperry Corp. director Thomas Morgan and TWA counsel Gerald Brophy.

—Katherine Johnsen

AVIATION WEEK VOL. 57, NO. 25
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AF Aircraft Deliveries Hit Postwar High

- **Gilpatric says manufacturers met 98% of schedules in November; farther stretchout appears doubtful.**
- **But production delays, engineering difficulties with J65 engines, F-89 and F-84F planes are reported.**

By Robert Hotz

Aircraft manufacturers are meeting their production schedules for the Air Force and no further stretchout is contemplated, according to USAF Undersecretary Roswell L. Gilpatric.

Deliveries of aircraft to USAF in November reached the highest point since World War II, Gilpatric said. A total of 666 planes, representing nearly 8 million airframe pounds, were accepted from manufacturers last month. The figures represented 95% of schedule by weight and 98% in terms of numbers.

Gilpatric emphatically denied that there had been any major shift in USAF production goals since the original stretchout of last January, although he admitted three new production schedules had been submitted to the Munitions Board since the A-16 stretchout schedule. However, the A-18 schedule (AVIATION WEEK Aug. 25, p. 14) called for deferring some 16 million airframe pounds of production from the next two years until late 1955 and early 1956. Normally USAF accounts for about 75% of total aircraft production.

Under a recent Munitions Board directive, Gilpatric disclosed, only one aircraft schedule a year will have to be filed by USAF and Navy unless the production program is changed by at least 10%.

▶ **Observers Agree**—Industry observers agreed with Gilpatric's analysis of the current USAF production situation. They noted that except for the specific problems mentioned by Gilpatric and the recent action by both USAF and Navy to phase out production of rapidly obsolescing types earlier than scheduled (AVIATION WEEK Nov. 24, p. 14), there were no indications of major changes in the offing. Gilpatric said that only a congressional limitation on expenditure of funds already appropriated could change materially the present outlook for the aircraft industry until 1956.

USAF contractors have nearly doubled their deliveries of aircraft during the past year, Gilpatric said. Deliveries for December are expected to total 733 planes, with 750 expected in January.

Plane Deliveries

The following table shows the number of planes actually delivered to the Air Force for the months specified and the schedule for future deliveries to mid-1956:

	Deliveries
November 1950	130
November 1951	365
May 1952	566
November 1952	666
Scheduled	
December 1952	733
January 1953	750
April 1953	800
July 1954	800
July 1955	500
June 1956	300

The peak production rate of 800 planes a month will not be reached until the second quarter of 1953, about four months later than planned under the stretchout program.

Although Gilpatric claimed there is no major lag in the Air Force production program as a whole, he admitted that production delays and engineering difficulties are being encountered on certain new aircraft and engine models. He cited:

- **Wright Sapphire (J65)** jet engine program.
- **Northrop Scorpion (F-89)** night fighter structural difficulties (AVIATION WEEK Dec. 1, p. 16).
- **Republic F-84F Thunderstreak** program.

Gilpatric said it will be necessary to replace aluminum compressor blades with steel blades in the first three stages of the Sapphire axial-flow compressor because of vibration problems at relatively low revolutions per minute. He said aluminum blades in the Sapphire are cracking under vibration encountered in the 4,000-6,000-rpm. range and that USAF pilots are instructed to get through this portion of the engine's operational range as fast as possible. Normal cruise for the J65 is 8,000 rpm. The critical range is encountered just after takeoff and just before landing.

▶ **Need New Blades**—Several months' production of the J65 will continue with aluminum blades to meet the demand for this engine by initial F-84F production at Republic's Long Island, N. Y., plant. These and other J65s already built will be re-fitted with steel compressor blades after Wright is in production on the new type blades. Gilpatric said Wright had designed and tested steel blades to U. S. standards and was planning to put them into production. He also said that similar vibration problems had been encountered in England on Sapphires built by the Armstrong-Siddeley Motors, Ltd.

Wright has built enough J65s to take care of the first F-84Fs now coming off the Republic line, but Gilpatric said the New Jersey engine plant was operating a "pilot production line" and still was in the process of tooling for its principal production. Wright has passed an official 150-hr. qualification test with aluminum blades and Gilpatric emphasized that "there is strong support for the Sapphire across the board in the Air Force."

Commenting on persistent press reports that the Sapphire production program was the prime bottleneck in the military aircraft production program, Roy Hurley, Curtiss-Wright Corp. president, said:

"The American people who are foot-

Stratojets

USAF now has two combat wings equipped with Boeing B-47 Stratojet bombers, AF Undersecretary Roswell Gilpatric says. Production of the Stratojet at Boeing's Wichita plant is expected to fall off soon from its current rate of better than one a day as the result of bringing the RB-47 photo-reconnaissance version into quantity output. At present, the B-47 modification centers operated by Douglas Aircraft at Tulsa and Grand Central Aircraft at Tucson are meeting Strategic Air Command's requirements for combat-equipped Stratojets, but SAC is getting fewer B-47s than originally expected. Douglas and Lockheed are expected to manufacture their first B-47s under licenses from Boeing early next year at Tulsa and Marietta, Ga., respectively.

ing the bill are entitled to know the truth about air power. Attempts are being made insidiously to discredit the remarkable record of aircraft production in this country. The net result could be to scuttle the aircraft production program and to interfere seriously with the defense of the United States."

▶ **Buffalo Statement**—At Buffalo, where CAW has a plant currently manufacturing aluminum compressor blades for the J65, Hurley said:

"The J65 engine is capable of developing substantially greater power ratings and these engines will require steel blades instead of the present aluminum alloy blades. The Buffalo plant is building steel blades which have passed their Air Force model tests.

"However, aluminum blades which the Buffalo plant is also producing are entirely satisfactory for engines of the present power ratings. The later use of steel blades will be a normal refinement to meet increasing power requirements. The design of the engine is such that the aluminum blades can be replaced by steel blades at any overhaul period."

A Curtiss-Wright spokesman said the J65 completed a 150-hr. teststand run using steel compressor blades in November. The J65 now has more than 5,000 hr. of teststand and flight test time, according to the spokesman.

Buick has not yet passed a 150-hr. test on its Sapphire and still lacks about five critical machine tools to complete its production tooling. Gilpatric said Buick would improvise substitutes for the critical tools to get under way.

▶ **Auto Men Learn**—"We find that automobile manufacturers are pretty cocksure that their methods are sufficient to tackle aircraft engine production," Gilpatric said. "And we have some quality control problems until they understand that aircraft engine builders' standards are considerably higher. This is true of Ford, Nash, Chevrolet and the rest of the auto licensees in the aircraft program."

The combined output of Wright and Buick will provide enough Sapphires to meet the growing F-84F production schedules and also to take care of the twin-jet Martin B-57 Canberra when it gets into production next year, Gilpatric said.

USAF expects Wright to continue Sapphire development and eventually come up with an 8,300-lb. thrust version similar to the rating now claimed by Armstrong-Siddeley after an official British 150-hr. qualification test. The current Wright Sapphire is rated at 7,200 lb. static thrust.

▶ **F-89 Too Fast**—Gilpatric said Air Force had concluded that the Northrop Scorpion disintegration at the Detroit Air Show last August (AVIATION WEEK Sept. 15, p. 17) was caused by pilot exceeding the critical airspeed for which the aircraft was red-lined below 10,000 ft. USAF pilots previously reported that the F-89 had been restricted to speeds under 450 knots below 10,000 ft.

The Republic F-84F program had slipped several months behind schedule, according to Gilpatric, but the situation is now improving. Two Thunderstreaks are now flying. He noted that there would be a temporary dip in Republic's production output as the plant shifted from F-84G Thunderjet to the new sweptwing F-84F.

"This will happen every time we switch production to a newer and better plane," Gilpatric said. "It will continue to happen as long as the Air Force retains its present leadership, because it is our policy to strive for constant improvement of the quality of our aircraft even at the expense of the maximum possible production.

"Republic is now the largest single producer of jet-powered combat aircraft this side of the Iron Curtain. I have no reason to doubt Republic's ability to accelerate production of the F-84F in view of its previous history in building up output of the F-84G to a rate of 10 a day."

Air Force has obligated about half of its fiscal 1953 procurement funds, and early in December reached a strength of 95 combat and troop carrier wings.

"While our aircraft program will continue to experience some delays in production and technical difficulties as long as we continue to stress qualitative improvement and to bring in new types, we anticipate no major setbacks in our program and no major changes to plague the industry," Gilpatric concluded.

COLLIER WINNER

John Stack, NACA aerodynamicist, and a group of his unnamed associates at the NACA Langley Memorial Laboratory were awarded the 1952 Collier Trophy for their work in developing a windtunnel capable of conducting research through the transonic speed range. Research results obtained from the tunnel have been a major contribution to production of U. S. combat aircraft capable of operating at the speed of sound, the Collier Trophy committee reported.

French Develop New Jet Braking System

(McGraw-Hill World News)

Paris—SNECMA is flight testing a "jet deviator" that twists the thrust of a jet engine something like 120 deg. toward the front giving a braking effect that permits landing on a much shorter strip.

Flight tests began July 26 in a Vampire equipped with a de Havilland Goblin engine. SNECMA (Societe Nationale d'Etude et de Construction de Moteurs d'Aviation) says the tests have been "very successful."

Design and performance data are secret, but SNECMA says officially:

"The goal sought of reducing the length of landing strips is attained. It is even possible to land and stop the airplane without using wheel brakes."

Although official information as to how the jet deviator works is unavailable, excellent sources give a general description. They say a number (eight or ten) of small jet nozzles circle the nacelle housing the engine. A mechanism switches thrust to these nozzles, which gradually turn thrust forward and increase braking action.

▶ **Vampire Test**—In the Vampire, twin booms on each side of the nacelle prevent the installation of nozzles at the side, so they are installed only at the nacelle top and bottom.

The deviator has been tested thus far only on the Vampire, but engineers say there is no reason the nozzles can't be installed on the sides of the nacelle in a plane of different construction.

De Havilland's Vampire was chosen for the initial testing because it is an operational French air force plane in a slightly modified type called the Mistral, powered by a Hispano-Suiza Nene instead of the Goblin.

The jet deviator has been under test more than two years. After a series of factory experiments, the deviator was installed on the Goblin in the summer of 1951 and put through a factory testbed workout.

▶ **British Interest**—From Nov. 22, 1951, to Jan. 3, 1952, a Goblin equipped with the deviator was tested in an air tunnel at Chalais Meudon under government supervision.

Installation of the deviator on the Vampire began Feb. 21 and that plane flew July 7 for the first time—without using the deviator.

SNECMA says the results of all these

tests are "very satisfactory—even spectacular." A mission from the British aviation industry already has watched deviator tests and is reported actively interested.

Breather Pilot Seat Eases Long Flights

The Air Force may adopt as standard equipment a pulsating seat designed to relieve the strain on fighter pilots kept in the air for long periods during missions stretched out by in-flight refueling. Service trials produced favorable reaction, according to reports.

After a few hours in flight, a fighter pilot gets tired from sitting and there's nothing much he can do about it. He must stay rooted in his seat for the length of the hop, shifting his weight around to ease pressure. Even the Navy's contoured seat isn't comfortable on long flights, it is reported.

The pulsating seat uses a "breathing" action to relieve pressure and promote circulation. The pulsating rubber cushion gets its pressure from the air supply to the cockpit canopy seal and a small cycling motor directs the air to the various compartments in the seat four times a minute. The pulsating action is reported to be so gentle the pilot normally isn't conscious the equipment is functioning. Its effectiveness is marked even for the duration of a 10-hr. flight, according to claims. Weight of the installation is about 1 lb.

It has been tried in conjunction with the Navy contour seat and reported highly effective in the combination.

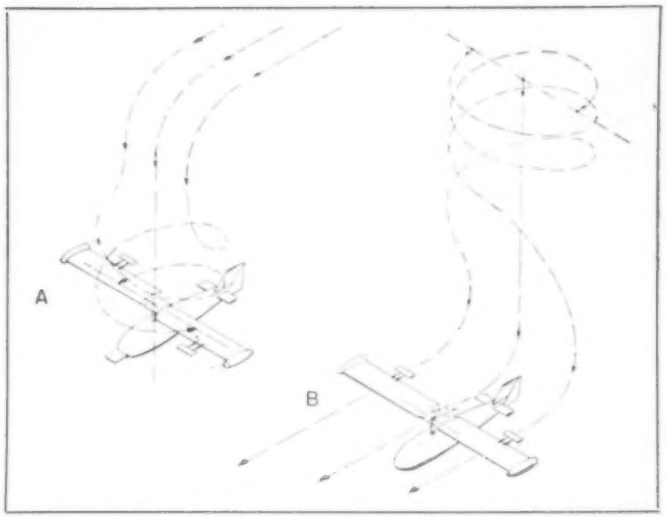
Lear VHF Set Gets CAA Certification

Lear, Inc., has obtained CAA type-certification of its 36-channel VHF transmitter-receiver, permitting its use on aircraft operating on scheduled interstate and foreign commerce.

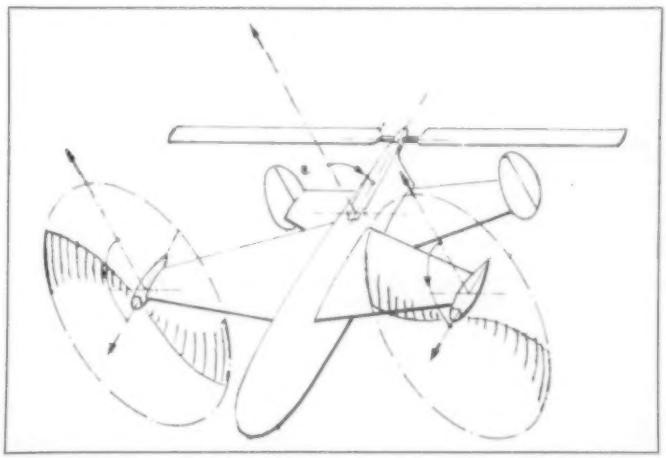
First announced earlier this year, the LTVR-36 includes a 5-watt 36-channel VHF transmitter, a 36-channel receiver, and a remote frequency selector. The set is designed to allow the transmitter to be installed and operated by itself, and the receiver added later, if desired. The LTVR-36 weighs about 20 lb. and can operate from either 14 or 28 volts d.c.

Crash Kills Cessna Official

Sherman S. Graves, general manager of the Cessna Aircraft Helicopter division, was killed in an aircraft accident last week at Richmond, Ind., Municipal Airport. A plane piloted by Graves and a Lake Central Airlines DC-3 collided at a runway intersection.



SWIVELED-WING contains jet engines at tips, acts as rotor for vertical flight (left) and is fixed for horizontal high-speed flight (right).



FIXED-WING design based on Pardel Duo-monoplane, has large tail rotor, which can be swiveled in conjunction with outboard props for vertical flight.

Army Cool Toward Convertiplane

By Alexander McSurely

Philadelphia—Brightest future for the convertiplane lies in development by private enterprise unfettered by government military or civil red tape, Grover C. Loening, Oyster Bay, N. Y., veteran engineer and apostle of rotary-wing aircraft, told the Second Convertible Aircraft Congress here.

The nature of government research organizations is incompatible with maximum achievement in new aviation fields, Loening told his audience, because of the necessity of accounting for each government research expenditure on a basis of return to the taxpayer. This, he said, negates the earnest efforts of many brilliant government researchers in military and civilian government establishments.

He forecast a trend toward more free enterprise research which would be able to risk capital in promising projects without demanding a 100% return on each of the projects, as government

accounting practices currently demand.

▶**Loening Warning**—Loening warned against premature regulation of convertiplane operations and specification by civil aviation agencies.

"CAA, at best, can never regulate on a more recent basis than last year's developments," he said. "This means that the manufacturers and engineers constantly will be forced to argue for changes of regulations based on last year's developments, in the light of newer developments which have happened since the regulations were made. CAA should make no attempt to regulate convertiplanes for 10 years, at least."

Indications that the Army is pleased with its present and forthcoming helicopters and is less eager than formerly to get into a convertiplane program were given by the Army spokesman at the congress, Col. William B. Bunker, chief of Army Air Transport Service division, U.S. Army.

▶**Army Switch**—"The old saying about building a better mousetrap is not enough this time," Col. Bunker said. "The cost factor enters in. There has to be a worthwhile overall saving, as well as a gain in performance."

Bunker indicated that if the helicopters could do the Army transport job adequately, as advance indications showed, the convertiplane's chances to replace it soon are not bright.

"Perhaps the helicopter may be obsolete in terms of the convertiplane, eventually, but all I can say is, it is no consolation to a mouse if he is caught in a mousetrap, whether it is obsolete or not."

The statement indicated a major switch from former Army thinking which called for initial Air Force contracts to three manufacturers, Bell, Sikorsky and McDonnell for convertiplane prototypes.

▶**Unorthodox Designs**—Earlier Army statements had indicated they considered helicopters as a stopgap until convertiplanes capable of relatively high speed forward flight as well as vertical takeoff and landing are developed.

An interesting array of unorthodox configurations, designed to combine the advantages of vertical and horizontal flight, were laid before the congress in a series of engineering papers illustrated with movies and model flights at the Franklin Institute Auditorium.

Highlights included:

• Wayne University, Detroit, demonstrated a rubber motor-powered twin-rotor convertiplane model which actually made vertical takeoffs and turned its rotors into horizontal thrust for forward flight.

• Viscount Louis de Monge de Francau of Flettner Aircraft Corp. discussed a number of various configurations for convertiplanes, including an arrangement for making the Pardel Duo monoplane design into a convertiplane with a rotor attached at the tail, which would be elevated on a vertical shaft for vertical takeoffs.

• Dr. J. A. J. Bennett, former British rotorcraft expert now on the engineering staff of Hiller Helicopter Corp., discussed a plan for using flying crane jet rotor helicopters to hoist conventional fixed-wing craft vertically out of downtown airports to eliminate the need for long runways. The plan also involves an aerial hitchup of the two aircraft for lowering plane at small airports.

• Similarity between the Hiller plan and an Air Force project at All-American Airways to carry a helicopter pickaback on a fixed-wing transport, which also involves the problems of aerial release and aerial attachment, was discussed. Problems of attachment particularly in instrument weather become complicated, it was indicated, and further work on the solution to these difficulties is needed.

• Prof. Alfred I. Roman of City College, New York, discussed a group of convertiplane designs which he has patented. They involve changing the angle of incidence of the wings by as much as 90 deg. to accomplish vertical and horizontal flight while the fuselage maintains its same attitude.

• Gerard Herrick, inventor of the Herrick Convertoplane, showed movies of his experiments in the 1930s with converted flight. Flight of a man-carrying aircraft which converted from fixed-wing to rotor craft in flight was included.

• David C. Prince, former General Electric engineer, discussed the pressure jet rotor system used on the Hughes XH-17 and his subsequent work on ramjet convertiplanes involving ramjet rotors.

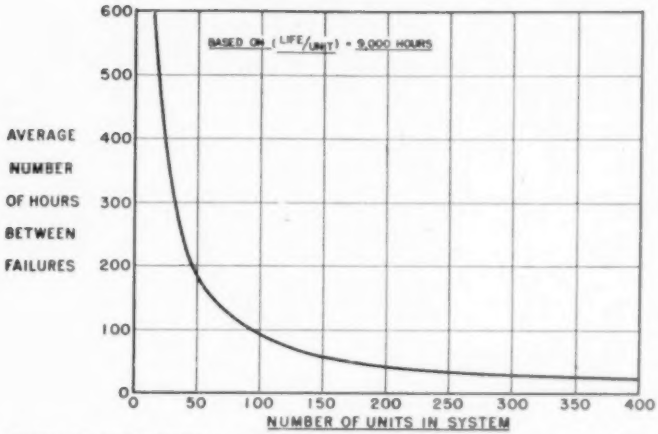
NCAA Probe Pushed

National Advisory Committee for Aeronautics faces a congressional quizzing early next year on alleged overemployment at its Lewis Flight Propulsion Laboratory in Cleveland.

Rep. George Bender will push for the investigation by House Committee on Expenditures in Executive Departments, of which he is a member. NACA states that a 111-man reduction in personnel at the laboratory is the result of an appropriation cut and does not imply that the laboratory has been overstaffed.

NEW GRUMMAN HUNTER-KILLER MAKES DEBUT

Pictured just prior to its first flight Dec. 4 at Bethpage, L. I., N. Y., is the new Grumman XS2F-1 anti-sub plane, which combines hunter and killer functions in one aircraft. The XS2F-1 has numerous electronic devices for seeking its prey in all types of weather. It carries a crew of four. Two Wright R1820 engines of approximately 1,300 hp. turn Hamilton Standard propellers. It is designed for short takeoff and landing distances off carriers and can cruise at low speeds while tracking its target. Note that a retractable tailwheel is used in addition to the tricycle main landing gear. Two different models of the earlier AF Guardian anti-sub plane were required to handle the function which the XS2F-1 now combines.



PRICE OF COMPLEXITY is pointed up in this graph depicting average number of hours between failures as a function of total pieces of equipment fitted to airliner.

Jet Prices Too High: Littlewood

Wright Brothers lecturer also tells how engineers could improve safety design of airliners.

William Littlewood, vice president-engineering for American Airlines, says U. S. airlines would not be interested in buying jet transports or powerplants "which threaten to cost anything like the numbers which have been quoted in the American press. The figures just do not smack of reality, or of any real desire to do the job."

The AA executive engineer addressed his views to aviation industry representatives in Washington, D. C., at the 16th annual Wright Brothers Lecture.

Although he didn't name names, he may have been referring to early reports that Douglas estimated it would take $30-$40 million to launch its four-jet DC-8, and production units would be price tagged at about $3 million each. Boeing has said that jet transport development might also run into eight figures and individual models would cost somewhere between $2.5-$4 million.

▶**Federal Funds**—Littlewood also took sharp issue with the slow rate of progress on jets in this country. He indicated that government subsidy might mean government interference in design and that airlines would not buy high-speed transport in which they had no voice in design and development. Some manufacturers have decided to finance their projects out of profits, without federal aid.

His 73-page paper, "Technical Trends in Air Transportation" detailed developments of the many refinements in airframe, powerplant and accessory equipment, which in a brief span of 25 years led to use of the airplane as a mass transportation medium. He also took note of the many achievements in designing inherent safety characteristics in today's transports.

But he frankly pinpointed numerous instances where improvements could be made in airliner design.

Littlewood said there are "pressures which are adverse to a quiet and thorough contemplation of safety in design, (but) there is no substitute for a constructively critical review of all design from a safety experts' point of view. We have not done it adequately—let's do it."

▶**For Safer Design**—Regardless of how future transport configurations emerge, the lecturer expressed hope they will be based on the low-wing design. ". . . The irrefutable advantage of low-wing design lies in the area of safety." And he developed this argument by discussing the low-wing's proven advantages in absorbing impact energy and for ditching.

WILLIAM LITTLEWOOD

As to rearward-facing seats, he said that "turning our existing seats to the rear would provide no more, if as much, safety as present . . . that any action or regulation which limits the direction of seats . . . would be premature and ill-advised."

"It is not difficult to see many ways in which aircraft crash safety can be made superior to any other" by proper design of chair structures, mountings, belts and elimination of hard or sharp objects or loose items of equipment that become flying missiles, he said.

Littlewood made some sharp comments on fire detection methods stating that in nearly 50% of the cases he knew of, the danger was initially spotted by passengers or crew members, or became apparent because of engine malfunction, rather than operation of the warning equipment. He said this has been because of improper location of detectors, deficient mounting on materials which failed easily or burned away, and destruction of circuits.

▶**Design Must**—Discussing equipment to prevent air-to-air collisions, the AA executive did not consider radar the final answer. Instead he urged more precisely controlled flight paths and development of cockpit indications and warnings possibly operated on the doppler principle.

Ready access to aircraft structures, he said, is a safety "design must" to check for materials fatigue, and the items should be made up so that they can be replaced with reasonable readiness. "It has been quite shocking" to find improper stress raising conditions, such as notches, holes and sharp cutouts in critical structures.

Littlewood also urged that all aircraft manufacturers be on the offensive for simplification, noting that there is a continuous development of good ideas adding complexity down through every department, but "no one apparently is devoted to taking things off." He saw the equipment miniaturization program as a highly beneficial one headed in the right direction.

▶**Maximums, Minimums**—Continuous progression of a good basic transport design to keep up with increasing seat requirements by stretching the fuselage was discussed by Littlewood, who said a modern contract and specification for future airplanes should make provision for increasing capacity and power.

Littlewood sees a range requirement for U. S. domestic jet transports as being bracketed roughly from 500-2,500 mi.; above and below these distances he believes turboprops will be utilized. At the absolute minimum of aviation ranges will come the helicopter. Safety factors

for the latter should require twin-engine power, especially for operation over congested areas. "The single-engine single-pilot transport airplane went out of vogue many years ago and we must question the safety factors of such helicopter operation," he stated.

One of the problems in jet transport operation will be landing deceleration, he noted, and he looks confidently to development of reverse thrust devices.

▶ **Local Service**—Since jet operations often will be carried out at altitudes well over 30,000 ft., there must be absolute assurance of no decompression failures, Littlewood pointed out. And aircraft fuselages must embody more favorable tear characteristics than present planes, to prevent considerable progressive failure following damage in flight.

In his discussion of a local service replacement for the DC-3, the American executive said such a plane probably would have similar engineering characteristics, with probably better landing and takeoff distance performance and improved single engine and flying qualities. Speed and altitude characteristics need not be much different. The approach would be to increase capacity.

Britain to Ask NATO Air Slash

By Nat McKitterick

(McGraw-Hill World News)

London—Great Britain is ready to recommend to North Atlantic Treaty Organization (NATO) a drastic reduction in the long-range West Europe defense goals, reliable sources here report.

Officials will not comment on exact figures, but Chester Wilmot, top British military writer, claimed in the Sunday Observer that British chiefs of staff recommend a goal of only 50 front-line divisions, 5,000 aircraft by 1955. That is about half what Supreme Headquarters (then under Gen. Eisenhower) and the U. S. plugged for at Lisbon last spring.

▶ **Strategy Change**—NATO strength now is estimated at 25 front-line divisions, slightly fewer "reserve divisions" and 3,600 aircraft.

The proposed reduction in the long-range target is in line with British assessment of the Russian threat—and the tight British financial situation. Real reason may be the bleak economic outlook, but it is obvious from recent statements by top officials that Prime Minister Winston Churchill is convinced the strategic outlook justifies reduced European commitments now.

Here are the main arguments:

• British believe the containment policy has been a big success in Europe. Intelligence claims Russia has failed to match the NATO buildup either on land or in the air. Again using Wilmot's figures, Britain doesn't think the Russians have added to the 22 divisions they had at the time of the Berlin blockade—most of which were only at 70% war strength. Nor do the British think the Russians have stepped up converting to a jet air force in keeping with NATO.

U. S. Air Force officials take issue with the British view, pointing out that the Soviet is in quantity production of the IL-28 twin-jet bomber, and has far more planes of the type in service than either the USAF or RAF. Russian MiG-15s in Europe still outnumber USAF, RAF and RCAF F-86 groups in England and France and, the Pentagon points out, the F-86 is the only NATO fighter capable of slugging it out with the MiG-15 for air superiority.

• As Churchill has indicated in almost every defense speech since last summer, Britain regards the Allied development in jet bombers as bringing back the deterrent threat of the A-bomb, which was lost when the Russians exploded theirs. The British argue that the Boeing B-47 and the Vickers Valiant, both of which should be well in service by 1954, greatly increase the ability of the Allies to deliver A-bombs to the Russian heartland.

USAF sources, however, do not feel that the Boeing B-47 Stratojet and the Vickers Valiant are contemporaries, pointing out that there already are two wings of operational B-47s and that more than 300 of these planes have been built by Boeing. Pentagon believes British estimate that the Valiant will be operational with RAF groups by 1954 is extremely optimistic. A USAF wing of B-47 bombers is scheduled to transfer to British bases next spring. Two Valiant prototypes have been built and a third is under construction.

▶ **Threat Eased**—The British expect the A-bomb bomber threat will force the Russians to concentrate more on their air defense at home, less on European air buildup. At the same time, the British have no evidence the Russians have anything in sight to compare with Allied bombers.

But USAF officials have publicly stated the Russians have several types of gas turbine-powered bombers under development to succeed their piston-powered TU-70 copies of the Boeing B-29.

The later British line led Churchill, Air Minister Lord de l'Isle and Dudley and Defense Minister Alexander to come out publicly in recent weeks warning against the dangers of sacrificing scientific development of air power for big spending on aircraft production now.

Churchill, always quick to appreciate new weapons, is believed to hold the view that revolutionary air warfare weapons are close enough to reality now to risk concentrating available resources on their development.

▶ **Middle East**—Part and parcel of the British reassessment of the strategic outlook is strong opinion that Asia and the Middle East are much more important now. This is a big form reversal for the British over the past two years.

Announcement from Downing Street this month favoring broadening the ANZUS pact into a Pacific defense organization, including Malaya, Indo-China, may point the way to the second big card Churchill has up his sleeve. Britain, like France, is known to favor a NATO-like structure for cold wars in the Far and Middle East. The French obviously want a greater U.S. commitment in their dire situation in Indo-China.

Top British officials in the past month again expressed hope the U.S. will be willing to shoulder part of the Middle East burden—preferably with troops.

▶ **The Rhine Bill**—The British treasury also is alarmed at prospects of footing the bill for the British Rhine army after Germany stops paying occupation costs in June.

Any increase in European commitment to Korea is bound to hinge on acceptance by the U.S. of part, at least, of these requests for burden-sharing. The British still are opposed to devoting more resources to Korea. Top officials say privately they see no military decision change there. But if President-elect Eisenhower comes up with a plausible program, chances are Britain will go along, provided the load is eased in other parts of the world.

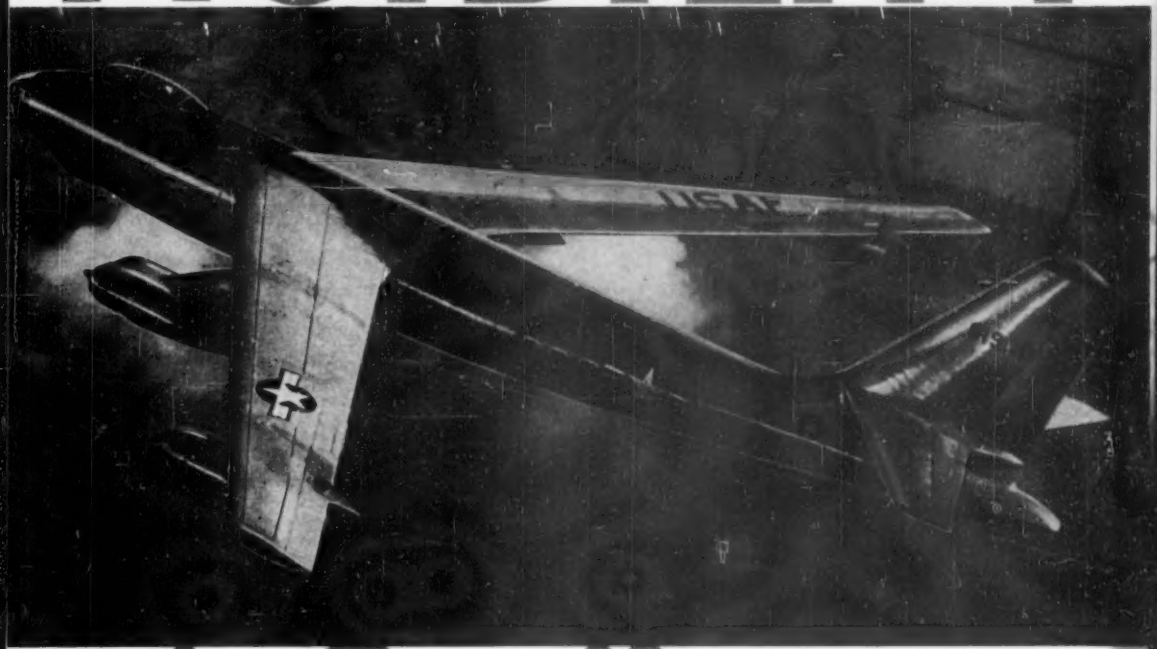
Decisions on these matters are certain to be a top subject of any Anglo-American talk next spring and will get priority above any requests for aid to support the strengthening or converting of the pound. The British realize the short-term risk their strategic assessment in Europe involves, but they contend that the long-term risk of economic suicide, plus collapse in Asia, is worse.

Foreign Use Permitted

Permission will be given foreign air carriers who are without a permit to operate from Gander, Newfoundland, to land or take off passengers and cargo at that airport under certain circumstances, according to new regulations of Canadian Air Transport Board.

The airport manager, after consulting with Canadian immigration and customs, can permit such landings in event goods or passengers being landed are for a licensed operating carrier at Gander, or in weather emergencies and delays of scheduled services.

VISIBILITY



by Swedlow

The BOEING B-47 stratojet is the fastest known bomber in the world. This great six-jet engine powered, swept-wing bomber will be produced in quantity for the U.S. Air Force by Boeing Airplane Company, Wichita, Kansas, the Douglas Aircraft Co., Tulsa, Oklahoma and the Lockheed Aircraft Corp., Marietta, Georgia.

Transparent laminated canopies and all-nylon fuel cell backing (in accordance with Boeing specification BMS-8-13) are SWEDLOW's contributions to the admirable functional efficiency of this superb fighting machine.

SWEDLOW was selected as a major supplier of these important factors because of SWEDLOW's unique reputation and more than a decade of experience in the development and fabrication of vital parts for the aircraft industry.

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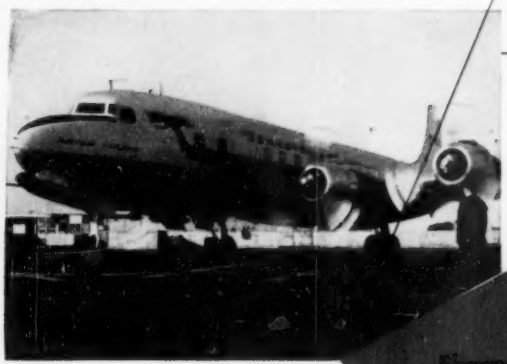

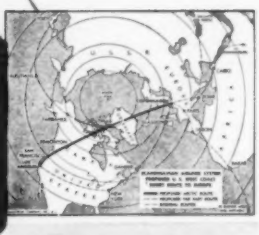

Accurate Simmonds Fuel Gages Used in Planning First Commercial Trans-Polar Service

On the recent history-making Polar flight by Scandinavian Airlines which cut hours from the West Coast to Europe, fuel was a major consideration. With only two stops in the nearly 6,000 miles from San Francisco to Copenhagen, the constant accurate measurement of the Douglas DC-6B's fuel supply by the Simmonds Electronic Fuel Gage was vital to the success of this first flight.

Simmonds introduced the electronic fuel gage to American commercial airline use over ten years ago. Today more than 40 types of commercial and military aircraft are equipped with Simmonds fuel gages. The Simmonds Pacitron represents this type of gage at the highest point of refinement and reliability. The improved amplifier-bridge of the system has been reduced in weight to only 1.12 lbs. and in size to 7⅛ inches long. It is shock-mounted internally for less bulk and greater installation ease. For the ultimate in accuracy and lightness, it's the SIMMONDS PACITRON.

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C-W Naturalizes Sapphire Jet Engine

- **Analysis finds British design too cumbersome.**
- **Wright redesign cuts cost, production time.**

By Irving Stone

British designs for airframe and engine components sometimes lead to production procedures considered laborious by American standards. An instance of this showed up when the Armstrong Siddeley Sapphire turbojet was brought to the U. S. by Curtiss-Wright Corp. late in 1950.

When Wright Aeronautical division engineers analyzed the British design for adapting it to American standards, one major part quickly got the spotlight. This component was the center main bearing support.

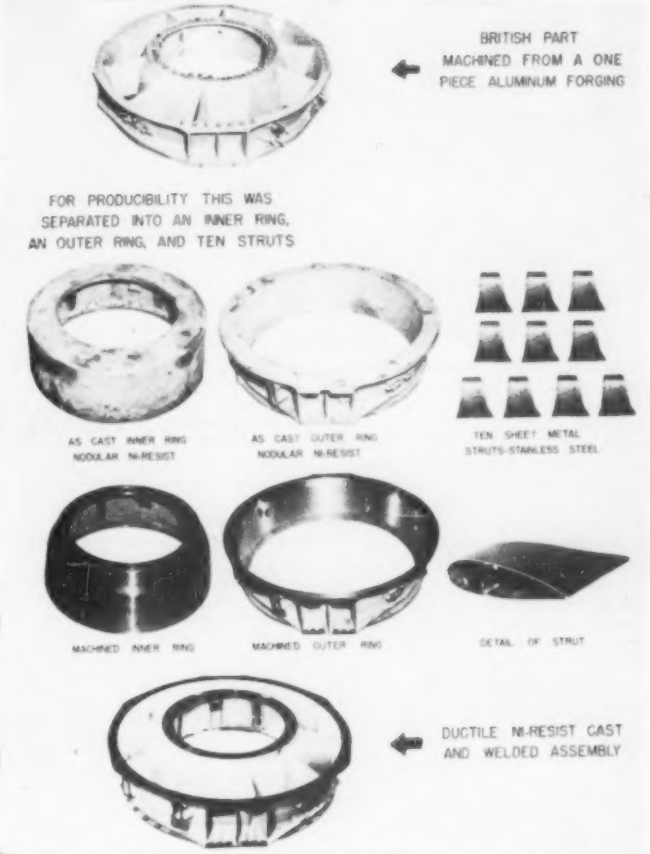
Located about midway between the inlet and exhaust, the support was a key part of the engine structure. Two trunnions attached to it carried almost the entire weight of the engine, also had to absorb all flight maneuver loads.

▶ **Cost Estimates**—Prototype Sapphires made by the British had a center bearing support which literally had been carved out of an aluminum alloy pancake forging (38 in. in diameter, 11 in. thick). Keller duplicating equipment was used to machine the contoured air passages. About 9 lb. of chips were produced for 1 lb. of finished product.

Wright Aero's analysis indicated that at American labor rates, minimum cost of making the part here from an aluminum contoured forging would be $5,700. Kellering time per part would be about 700 hr.—meaning that one duplicating machine on a three-shift basis would produce less than a single unit per month. Also, USAF requirements imposed higher operating temperatures and greater peak stresses than those which the British part had been intended to withstand.

▶ **New Approach**—A special group was set up in Wright Aero's engineering department. Their job:

- **Redesign the center bearing** support so complex contour machining is eliminated.
- **Establish production procedures** for fast and economical processing of the part.
- **Replace the aluminum alloy** with materials having greater strength at elevated temperatures.


BRITISH PART MACHINED FROM A ONE PIECE ALUMINUM FORGING
FOR PRODUCIBILITY THIS WAS SEPARATED INTO AN INNER RING, AN OUTER RING, AND TEN STRUTS
AS CAST INNER RING NODULAR NI-RESIST
AS CAST OUTER RING NODULAR NI-RESIST
TEN SHEET METAL STRUTS-STAINLESS STEEL
MACHINED INNER RING
MACHINED OUTER RING
DETAIL OF STRUT
DUCTILE NI-RESIST CAST AND WELDED ASSEMBLY

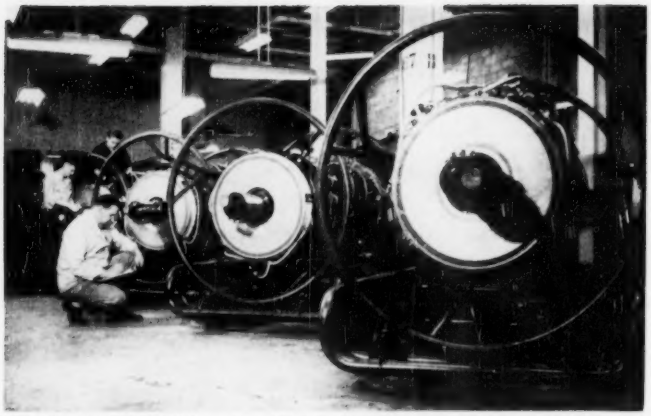
SAPPHIRE ENGINE center main bearing support was machined from one-piece pancake forging in British design (top). Wright Aero redesign—with cast inner and outer rings, sheet metal struts—slashes cost and time required to make the part.

A quick solution encompassed a breakdown of the part into an inner and outer cast ring separated by 10 struts shaped from sheet metal and welded to the rings. The rings were to be left largely as-cast, requiring only limited machining on a lathe, facing of pads and boring and threading holes.

▶ **Nodular Iron Selected**—In the search for the ring material, metallurgical engineers ruled out grey iron because it was too weak and brittle. Working with cast steel was deemed too difficult to hold the close tolerances required.

Nodular iron was chosen—a relatively new material, with both the temperature-resistance and the toughness required in the support. (Nodular iron is a development of International Nickel Co.). The material is ductile, bends about as easily as steel and has strength superior to grey iron. It has the carbon collected in nodular form, leaving an almost continuous matrix. This results from inoculation of the material with magnesium and nickel (serving as a carrier), before pouring.

Costs projected on a volume basis



WRIGHT J65 SAPPHIRE was brought from blueprint to mass production in 16 months This 7,200-lb.-thrust engine powers the F-84F Thunderstreak.

—with the Wright redesign and using nodular iron—were estimated by Wright Aero's engineering team to approximate $648 for the castings, $250 for machining, $20 for struts, and $25 for welding. This gave a total of $943—about ⅛ the price for the job starting with a contoured forging, and about 1/10 of the cost using a pancake forging as employed by the British.

▶ **Rings Cast**—American Brake Shoe Co.'s experimental foundry, Mahwah, N. J., was given the contract to develop a suitable casting technique for the inner and outer rings. Some early samples continued unstable austenite, and minor changes in the nodular alloy were required.

Brake Shoe finally achieved uniform results with a high-nickel alloy that had a coefficient of expansion to fit the parts bolted to the support—the aluminum compressor housing and stainless burner housing.

Lab analyses showed that the nodular iron withstood maximum temperature requirements. At 750F, the iron base alloy is about six times as strong as the original aluminum alloy, on the basis of short-time tensile tests. The redesigned support is only about 15% heavier (maximum) than the aluminum part.

▶ **Strut-Wing Weld**—Fabrication and welding of the struts themselves presented no problems. Difficult job was to work out a method of welding the stainless struts to the nodular iron rings. Wright Aero engineers came up with a 431 stainless wire which was reasonably compatible with the metallurgy of both the modular iron and the 18-8 strut material.

Welds were submitted to Rayflex testing to evaluate strength under vibration loads. Although deflection of simulated struts measured about 0.1 inch, the joint held firm. This was in excess of any condition likely to be encountered in an engine in flight. Final proving with the welded support was in a test frame to duplicate static maneuver loads. Pressure applied by the hydraulic jack was far greater than the loads that would be encountered in dives, climbs and turns. Subsequent inspection disclosed no failure of the materials or connecting welds.

▶ **Processing**—Five months after the start of the project—March 1951—Brake Shoe was producing castings to a dimensional accuracy of .030 in.

At Wright Aero, the rings were processed first by rough and finished turning of the air passages to a tolerance of .005 in., then similar rough and finish turning on other parts of the castings. Struts contoured to a tolerance of —.003 in. were welded in place, requiring about 25 ft. of fillet deposited at speeds up to 2 fpm. Final operations on the support are finish turning, facing the pad and drilling and tapping holes.

▶ **Flown in F-84F**—Six months from the start of the project, the first center bearing support was ready for installation in a YJ65 Sapphire. Test cell trials were satisfactory and the engine passed its 150-hr. model test with a nodular-material support. The new assembly also has been flown successfully in Republic's F-84F.

However, development is still continuing. Aim is to reduce the amount of nickel now required for the nodular-material support. Initially it was hoped to use a ferritic material (low in nickel) to save on strategic materials, but this produced dimensional changes that could not be tolerated on the as-cast surfaces. The relatively low coefficient of expansion of the material also introduced other problems.

As now constituted, the nodular material contains these percentages of elements: carbon, 2.7-3.3; manganese, 1.9-2.5; silicon, 2.2-3.2; phosphorus, 0.15 maximum; sulfur, 0.05 maximum; chromium, 0.50 maximum; molybdenum, 0.30 maximum; and nickel, 21.26.

PRODUCTION BRIEFING

▶ **Bendix Aviation Corp.** has virtually completed a new environmental test building at company's missile section in Mishawaka, Ind., which will expand activities dealing with missile development and production.

▶ **Cleco division** of Reed Roller Bit Co., Detroit, has opened new sales offices and a warehouse at 18071 Wyoming Ave., Detroit.

▶ **Jack & Heintz, Inc.**, Cleveland, received major orders during October from Boeing Airplane Co. for hydraulic and electric actuators, electric motors and electric control panels; orders for inverters came from the Aircraft Appliance Co. of Canada. Total orders received during the month amounted to more than $3 million.

▶ **Sightmaster Corp.**, New Rochelle, N. Y., has incorporated a new subsidiary firm, Sighmaster of California Co., at Gillespie Airport, Santee, Calif., to manufacture and market Chemalloy metal and microwave calorimeters. Three firms were consolidated to form the new subsidiary: Electronic division of Transport Products Corp., Louisville, Ky.; Technical Products and Services Co., and Chemalloy Associates.

▶ **Metco Corp.**, Dayton, has been founded to develop and manufacture test equipment and training devices.

▶ **Southwest Products Co.**, Pasadena, Calif., will move into their new factory building at 1705 So. Mountain Ave., Duarte, Calif., during the first week of January. The company makes Monoball bearings, rod end bearings and mechanical push-pull controls.

▶ **Reynolds Metals Co.**, Louisville, Ky., has awarded a contract for construction of its Robert P. Patterson aluminum reduction plant at Arkadelphia, Ark., scheduled for completion by July 1953, to Ditmars-Dickmann-Pickens Construction Co., Little Rock, and W. S. Bellows Construction Co., Houston.

▶ **Sub-Zero Products Co.**, Cincinnati, is the new name for the Sub-Zero Products Manufacturing division, Deepfreeze Distributing Corp. The firm makes metal chilling machines.

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Overseas, Monsanto Skydrol is obtainable through marketers of Esso Aviation Products

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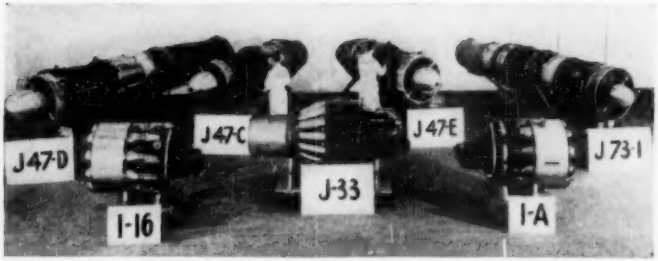


Family Photo of GE Jet Engines

General Electric Co.'s jet engine development history is telescoped in this photo showing how this powerplant-type has changed and grown:

• **I-A,** first jet plant built in this country, was a centrifugal-flow, experimental engine based on the Whittle W2B. Rated thrust was 1,300 lb., weight was 800 lb. Two I-As were installed in the Bell XP-59A, first U.S. jet-powered plane to fly (October 1942).

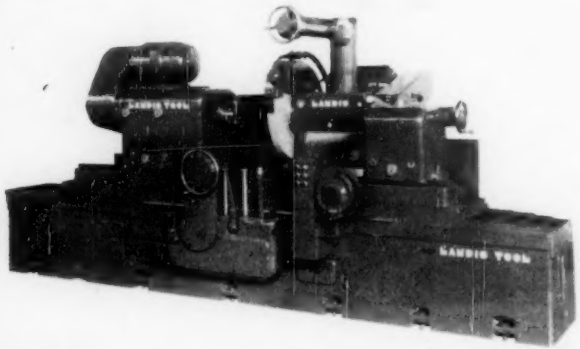
• **I-16 (J31)** was the first series production GE turbojet. Thrust rating was 1,600 lb., weight was 840 lb. It flew in the Bell P-59A and Ryan FR-1 and XF2R-1.

• **J33 (developed as the I-40)** was first delivered for test in January 1944, and developed a thrust of 4,200 lb. Weight was 1,865 lb. It was installed in the first Lockheed XP-80A Shooting Star and was first flown in June 1944. Shortly after the end of the war, complete responsibility for the engine was transferred to Allison division of General Motors Corp.

• **J35.** Engineering and manufacturing responsibilities for the J35 (not shown) also were taken over by Allison in 1947 after it had built them in quantity. This engine (also known as TG-180) was the first axial-flow turbojet developed by GE. It was rated at 4,000-lb. thrust, weighed 2,300 lb. First flight was in the Republic F-84, in February 1946.

• **J47** and the J73 units show the sharp transition in configuration from the early designs. The J47-C and -D were tagged with a 5,200-lb.-plus thrust rating, the former weighing about 2,500, the latter about 3,000 lb. The -E jet carries a 5,800-lb.-plus thrust rating and has a weight of 2,550 lb.

• **J73-1,** latest of the units shown, is in the 8,500-lb.-thrust class.



Machine Grinds Large Jet Parts

Turbojet engine rotors and other large-diameter aircraft work can be handled on CHW Plain Grinder engineered to fill a gap between small-size standard machines and large, heavy-duty units.

The grinder is made in versions having 30-, 36- and 48-in.-diameter swings. Lengths between centers are 48, 72, 96 and 120 in. Variable-speed headstock drives are standard, but constant speed is available. The slide under the wheelhead, operated either manually or by power, is a double-type to allow for a large amount of base movement. Hydraulic table traverse is adjustable to any desired speed between 3 and 130 in./min.

Swivel table may be adjusted to grind tapered work. Microsphere bearings are designed to give accurate response to wheel feed changes and quick, positive spark-out. Eye-level wheel feed enables operator to watch grinding action from the same position from which he adjusts the wheel. Extra movements which increase fatigue and slow set-up are eliminated, according to the developer, Landis Tool Co., Waynesboro, Pa.

Dip-Brazing Speeds Aluminum Work

A new dip-brazing plant for aluminum parts has been constructed by United Aircraft Products, Inc., Dayton, Ohio.

Reported to be the largest facility of this type in the aircraft industry, the operation was completed in four months to meet production schedules for more than $1 million in initial contracts for brazed assemblies.

Essentially, the process involves melting the joining material and fusing it with the parent materials by dipping the assembled components in a bath of molten brazing flux.

Accessibility to joints is no problem. Heat of the bath is maintained automatically, with all parts brought to the same temperature, eliminating distortion from differential expansion. Another advantage of the process is reported to be uniformity of parts appearance, pressure-tightness and joint strength, with little skill required by the operator.

In addition to being faster than the hand-welding technique, the process makes it possible to braze parts which could not be hand-processed, it is reported. The company cites an example to show the process' speed advantage: One assembly was dip-brazed in 47 minutes, against a two-hour period which would be needed if hand-torch brazing were used.

New Copter Engine In Production

The Continental R975-42 radial engine, designed specifically to meet rotary-wing aircraft requirements, is in production for Piasecki's HUP-2 copter. This new engine model is a refinement of the R975-34 used in the HUP-1. It develops 550 bhp. against the latter engine's 525 bhp. Dry weight without mounts, but including carburetor, air deflectors, ignition and priming systems, is 732 lb.

The engine is adapted for installation in various copter types. With addition of a small amount of external equipment it will operate in any attitude from horizontal to vertical, says the maker, Continental Aviation & Engineering Corp., Detroit.

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The Bendix Ignition Analyzer is available for either airborne or portable-airborne installations. It can be used with either high or low tension magneto or battery ignition. It is the ignition analyzer that can predict spark plug failure before it occurs . . . make an efficient check of more than one spark plug at a time and do so on a large, easy to read screen . . . yet it costs less than comparable analyzers.

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Glass Fabric for Plastic Assemblies

A glass fabric which stretches while the yarn remains stable, stated to be the first of its kind developed, has been announced by Hess, Goldsmith & Co., for use in plastic assemblies found in aircraft.

Primarily a base for reinforced plastics, the product, Form Fab, can be used where pre-forms now are used, according to the firm. The company believes the material will find many applications in such curved molded sections in aircraft as wingtips, radomes, heating ducts and other parts.

The fabric has up to 70% elongation and it is said, equal strength can be obtained in all directions. When laminated with polyester resin it can be molded into practically any shape or size, with little heat and low pressure, Hess, Goldsmith claims. The resulting material can withstand exposure to temperatures up to 500F. It comes in thicknesses of .009 in., .012 in. and .018 in.

Company tests show the .012 fabric has an average breaking load of 567 lb./in. of width in the warp and 349 lb./in. of width in the filling. It weighs 11.79 oz./sq. yd.

Hess, Goldsmith & Co., 1400 Broadway, N. Y.

USAF CONTRACTS

Following is a list of USAF contracts recently announced by Air Materiel Command.

Beech Aircraft Corp., Wichita, miscellaneous spare parts, $100,000.

Crosley division, Avco Mfg. Corp., Cincinnati, radio receiver, 2,363 ea., $729,620.

Davison Chemical Corp., 101 N. Charles St., Baltimore 3, dessicant non-indicating, 16,751,312 ea., 8,512,304 ea., 57,095,456 ea., $864,568.

Dynamic Electronics Inc., 73-39 Woodhaven Blvd., P. O. Box 188, Forest Hills, L. I., N. Y., mounting, 6,507 ea., 1,240 ea., $55,486.

Edison, Thomas, Inc., West Orange, N. J., kits, 968 ea., 351 ea., 434 ea., $1,161,820.

Fletcher Aviation Corp., 190 W. Colorado St., Pasadena, kit, 11,870 ea.; cylinder, 3,000 ea., plunger, 4,000 ea., $594,847.

Goodrich Co., B. F., 803-4 Winters Bank Bldg., Dayton, wheel assemblies, 189 ea., 240 ea., brake assemblies, 480 ea., $298,847; wheel assemblies, 3,538 ea., brake assemblies, 5,123 ea., $329,091.

Land-Air, 440 Superior St., Chicago, antenna kits, 950 ea., service bulletin, 1 ea., $67,341.

Lycoming-Spencer div., Avco Mfg. Corp., Williamsport, Pa., engine, 35 ea., spare parts, 1 lot, $51,233.

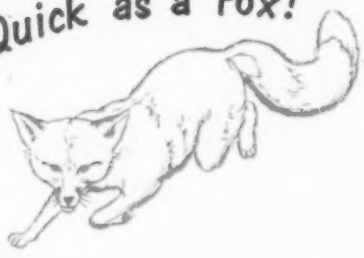
Radiant Lamp Corp., 300 Jelliff Ave., Newark 8, N. J., stereopticon motion picture, 27,814 ea., $50,899.

Sunbeam Corp., 5600 Roosevelt Blvd., Chicago, indicator, 1,670 ea., $77,525.

Watts Mfg. Co., Ronceverte, W. Va., kits, spare parts, 237 ea., $147,249; case, 5,000 sets, $247,200.

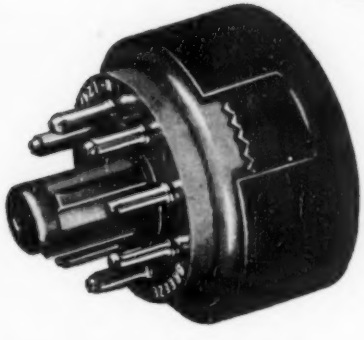
RUGGED as a RHINO . . .

Quick as a Fox!



Two Special Purpose Connectors *by*

BREEZE MARK

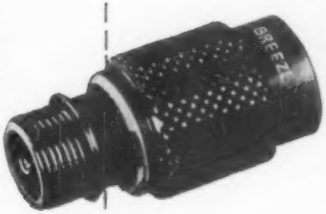


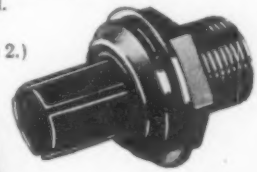
Battery Connectors

8-pin type for both A and B batteries used in all types of field communication equipment. "RUGGEDIZED" for extra security and long service life: polarizing stud is ALL METAL and all metal parts are cadmium plated and sealed with an iridite sealer. Cable may be brought out at any desired side position and locked. Handy bail makes removal from inaccessible places easy.

Quick Disconnect

Simply push male and female members together and lock. To disconnect with minimum resistance, pull back sleeve on plug shell and disconnect. Exceptionally low disengaging force required (less than 6 lbs., excepting pin friction). Vibration proof, moisture-proofed with synthetic rubber insert. Meets AN pin pattern and voltage requirements, in accordance with MIL C-5015. Plug shell and coupling sleeve are aluminum alloy, cadmium plated and iridite-sealed. (Federal Spec. QQP – 416, Type 2.)





Receptacle Types: Round flange single hole panel-mounted, square flange for 4 bolts, or specially flanged to specification. All contacts silver plated.

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Flight Lab Learns to Tame Stalls

Cornell study indicates how stall may become routine landing maneuver, allow jets to brake in mid-air.

By Scott H. Reiniger

Buffalo—After years of studying the aerodynamic stall, pilots and scientists of Cornell Aeronautical Laboratory's Flight Research Dept. have learned to ride it and manage it, with new automatic stability controls.

They have not only made an aircraft controllable while completely stalled out, not simply kept it within minimum bounds of control, but have precisely guided it. John Seal, chief pilot of Flight Research, and winner of the Octave Chanute award for his work on flight stability problems, has ridden the stall all the way down to the ground many times.

A special servo system automatically controls the plane for lateral stability in these tests. The pilot keeps the nose up throughout the stall by cranking the horizontal tail surfaces to a negative angle of incidence, to create heavy downward drag on the tail. During the stalled descent, the craft assumes an angle of attack of up to 28 deg.

▶ **New Flight Maneuver**—Flight Research's director, W. F. Millikin, Jr., told AVIATION WEEK that his group has gone a step further than taking the danger out of riding out a stall. It has experimented with ways of using it as a legitimate flying maneuver. He thinks the stall, properly handled, may offer a new dimension of flight, making flying safer.

In developing his piloting technique in the new maneuver, Seal has found the plane can be landed as well by this method as by others. As he nears the ground, he flares out from the steep stalled descent under full power and lands with a short roll. Forward speed is less than in conventional landings.

▶ **For Braking Jets**—The controlled stall may be a solution to braking sleek jets efficiently in mid-air. Scientists here think jet transports might perhaps be landed more safely and with greater ease and economy by stalled descents from service altitude than by conventional means—somewhat like a helicopter in auto-rotation. Naturally, passenger reaction would be a big factor in determining whether such a landing maneuver could be adopted.

Keeping in mind that this is still only a successful laboratory experiment, here are some of the advantages a stalled descent might offer over present landing techniques:

- **Letdown covers smaller area,** reducing risk to inhabitants near airports.
- **Landing roll is shorter,** so smaller fields, with reduced ground clearances around airports, are possible.
- **Need for drogue chutes** or other accessory means of braking may be eliminated as a result of short landing roll.
- **Fuel savings and tight scheduling** might result from the jets' ability to brake fast in mid-air, drop fast on landing point.

The stalled descent may become a completely automatic operation. Cornell is working in this direction. The maneuver became possible only through partial automatic control in the first place.

Flight Research's entire approach to the problem is revolutionary. Instead of making the plane stall-proof, this group seeks to make it responsive to control in a stall.

▶ **Like Sonic Region**—There is a parallel between the early stages of the stall and transonic flight. In both, the forces on the plane are unpredictable. In this "trans-stall" region, the plane is in a crisis of indecision, whether to stall or not. The craft shudders and shakes and the stall may start, then recede, then build up again. It may originate from one or another quarter or from several points. There may be lift at some points of the wing and none at others.

If the stall forces prevail—continuing the parallel, this could be called the "super-stall" region—they must be contended with, but they have settled down to a predictable pattern.

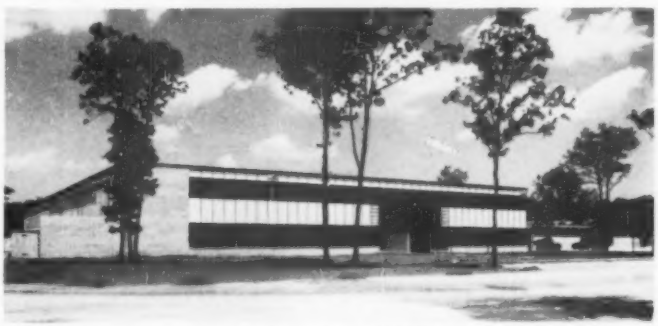
It is this "steady state" condition of the stall where the group has made its most fruitful explorations. It has devised methods of studying dynamic behavior of aircraft and has extracted data sufficient to establish basic formulations for design work and improvement of aircraft control generally.

The controllable stall is one of the fruits of dynamic stability and control studies instituted in 1946 by Flight Research. The group has been recognized internationally and is a world leader in this field of development.

Involved in this work are some 30 large projects sponsored by the Air Force, Navy and Cornell Aeronautical Laboratory research funds. Flight Research's hangar is well-stocked with late-type military craft for carrying out its work.

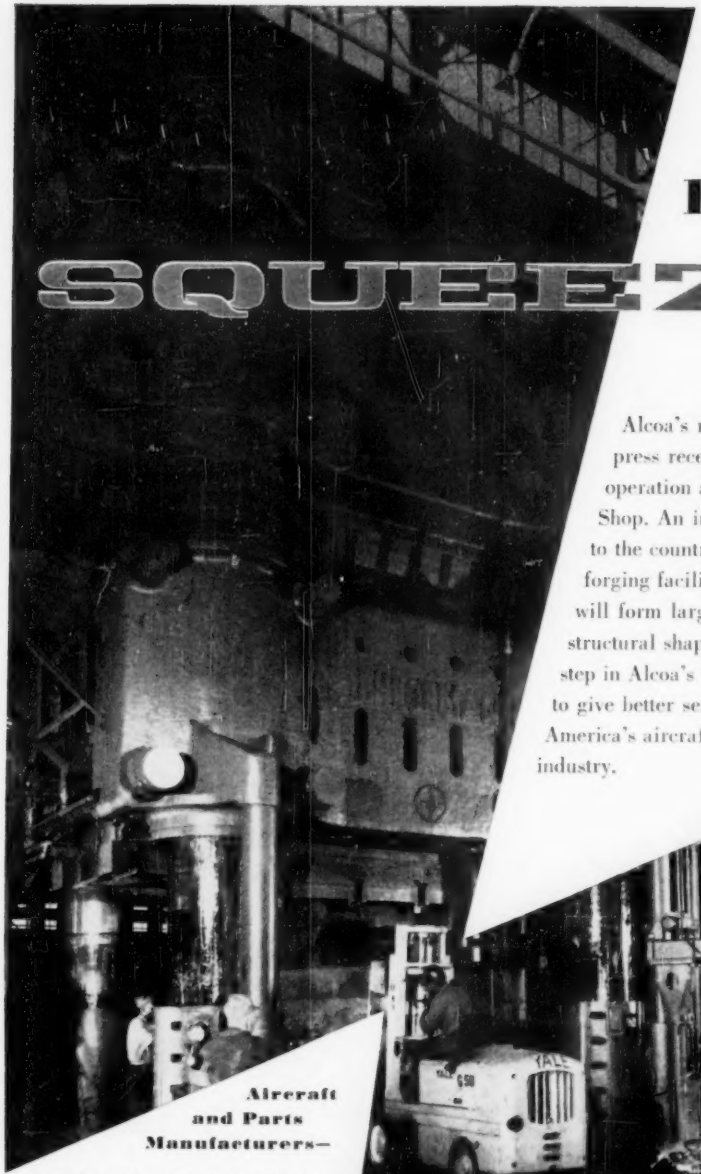
▶ **Stability Research**—Cornell is developing artificial stability controls to make aircraft more stable and easier controlled in all conditions of flight. These are automatic sensing devices and servomechanisms connected into the pilot's flight controls which react to characteristic oscillation signals and damp out random disturbances whenever controls are moved. The system is new in the way it is applied, but the components are not.

As opposed to this generalized approach toward stability, there is "Little Herbert," a yaw damper servo system developed by Boeing Airplane Co. to



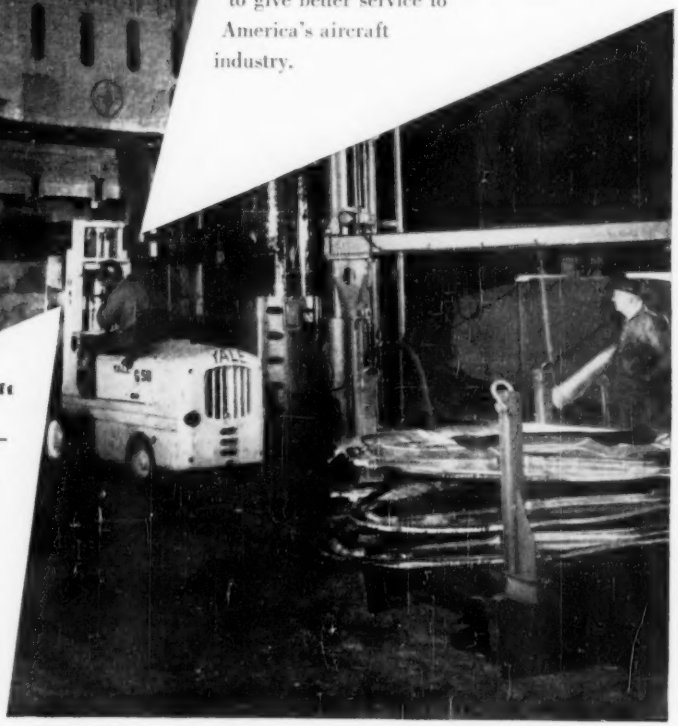
STRATOS GOES MODERN

This is the new home of Stratos div., Fairchild Engine & Airplane Corp. at Bayshore, L. I., N. Y. The plant houses all activities of the company, including manufacturing, engineering, sales, administrative and executive. It was erected on a 25-acre site, and built with an eye to easy expansion. The plant has 27 test cells, a compressed air capacity of 400 lb./min., has facilities for simulating altitudes of up to 55,000 ft., incorporates air conditioning equipment with a capacity of 187 tons, has 700 employes. Architects: Fordyce and Hamby, associated with Raymond Loewy.



The 15,000-Ton SQUEEZE

Alcoa's new 15,000-ton forging press recently went into operation at the Cleveland Forge Shop. An important addition to the country's largest aluminum forging facilities, this new press will form larger and more intricate structural shapes. It is the first step in Alcoa's "big press" program to give better service to America's aircraft industry.



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should have Alcoa "How-to-Do-It" books and sound movies to train their employees. Ask for any of the following books: *Forming Alcoa Aluminum, Designing for Alcoa Die Castings, Designing for Alcoa Forgings, Alcoa Aluminum and Its Alloys.* Sound films are available on most fabrication processes.

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prevent "Dutch Roll," an oscillation of the tail. This is a specialized approach, directed at one aspect of stability.

Flight Research's work amounts to complete reassessment of present methods of controlling aircraft.

These systems are not to be confused with autopilot controls which correct and bring the plane back to a preselected attitude, altitude and heading. Artificial stability controls are designed, rather, to make response of the plane to any adjustment of the controls, whatever it may be, as nearly perfect as possible, without hunting. The pilot has little need to correct or jockey after initial movement of the control.

Cornell says it has achieved a degree of stability and control in actual flight that is far above that experienced in conventional flight.

Rocket Papers

Trends, tests and techniques of rocket science were reported in 23 technical papers and speeches at the recent seventh annual convention of the American Rocket Society in New York.

Experimental results shared the spotlight with theoretical studies in subjects which ranged from rocket motor combustion and instability to the use of small freight-carrying rockets for establishing a large satellite in its orbit.

Because of their general interest and significance for the future, AVIATION WEEK is printing technical summaries of some of the more important papers. The first group follows:

▶ A Survey of Combustion Instability in Liquid Propellant Rocket Engines. R. S. Levine and R. W. Lawhead, North American Aviation, Inc.

Smoothness of propulsion system operation is a necessity for missile dependability and accuracy. Combustion instability is a recurrent problem in the design of rocket motors, especially in the large sizes of such engines. Destruction may result from mechanical failure following instability, or burnout due to local high heat transfer rates.

In smooth operation, it is possible that chamber pressure fluctuations can be less than one-third of a percent of the average chamber pressure, but this is exceptional. A 10% variation in thrust or chamber pressure is sometimes considered acceptable; and in rough operations, the fluctuations may approach 100% of the average thrust.

Four classes of combustion instability are discussed:

- Propellant flow fluctuations actuated by combustion time delay (50-500 cps.).
- Propellant flow fluctuations caused by control system instabilities (up to 50 cps.).
- Acoustic resonances of the combustion chamber (400 cps. and up).
- Inability of combustion to stabilize itself (40-3,000 cps.).

The authors expect much progress in this field in the near future so that it may be possible to eliminate combustion in-

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stability in the design stage of rocket engines.

▶ A simplified Combustion Analysis System, R. K. Neumann, D. Dembrow, W. G. Berl and R. Prescott, Applied Physics Laboratory, Johns Hopkins University.

A gas analysis system has been developed which combines thermal conductivity measurements with a chemical analytic scheme. The system has been used extensively in tests of ramjet engines, although it can be applied directly to other hydrocarbon-air engines and modified for other types.

It can be used for discrete as well as for continuous determinations, for local point-by-point traverses, and for various fuels. Response time is short; a complete analysis takes from 30 sec. to two minutes and shows an accuracy of 2 or 3%.

▶ Combustion Studies in Rocket Motors, Kurt Berman and Samuel H. Cheney, Jr., General Electric Co., Malta Test Station.

Further data on combustion instability in rocket motors, studied with the aid of a rocket motor having a full-length observation window, are presented by the authors.

It has been established that high-frequency combustion instability in small-diameter motors is the result of pressure-pulse propagation along the length of the motor. The frequency of oscillation is a function of the cylindrical chamber length of the motor. The severity of unstable operation is increased by low injector-head pressure drop, long chamber lengths and large nozzle convergent angle.

In the case of very large-scale oscillation, film-strip records show the existence of shock waves. The flow field has been measured ahead and behind the shock front.

▶ The Atmospheres of Earth and Mars in the Light of Recent Physiological Concepts, H. Strughold, M. D., Ph.D., Dept. of Space Medicine, USAF School of Aviation Medicine.

The space equivalent conditions concerning anoxia and the boiling point of body fluids are found at 50,000 ft. and above in the earth's atmosphere. On Mars they begin at the surface. Thus the Martian atmosphere is nothing more than that zone in the terrestrial atmosphere which has just recently been termed the aeropause.

Therefore the Martian atmosphere, as physical environment, is completely unphysiological for high living beings as we know them.

Apart from the conclusions with respect to Mars, comparative study demonstrates the extreme conditions which confront the present-day high-altitude flyer. To fly above 56,000 ft. would mean flying under Mars-equivalent conditions, which may serve to emphasize the importance of protective measures and equipment for flights into the aeropause.

▶ Escape and Survival in Space Travel, Fritz Haber, Dr. Ing., Dept. of Space Medicine, USAF School of Aviation Medicine.

The problems of escape and survival can be characterized by their distances from the earth.

- In the first group are those accidents which occur at a very great distance from earth, such as with an interplanetary ship. In this region, it is very unlikely that a man would survive explosive decompression, even if he were wearing a pressure suit. Survival, even after a normal exit through an airlock, would be hopeless because of the limits of pressure suits.
- In the second group would be accidents which occur closer to earth, such as in the vicinity of a satellite. The main difficulty in rescue operations would be location of the victim. Proper means of communication are vital to such an operation.
- In the third class are accidents which occur where the atmospheric influence can be felt. A man falling freely through the outer belt of the atmosphere would be subjected to a deceleration on the order of 300G on arrival at the top of the atmosphere, and this deceleration would be fatal. Furthermore, heating of his body due to air friction would also occur at a very high rate. Even if the deceleration could be avoided, the man would be burned to death.

▶ The Application of the Ramjet to Aircraft Propulsion, Malcolm Harned, Chief Designer, Marquardt Aircraft Co.

The ramjet is a powerplant with enormous potential application in the Mach number range between 2.0 and 4.0. In this range it offers the minimum fuel consumption, highest thrust-weight ratio and minimum initial cost per horsepower of any air-breathing powerplant.

This paper was abstracted in considerable detail in AVIATION WEEK Dec. 15, p. 21.

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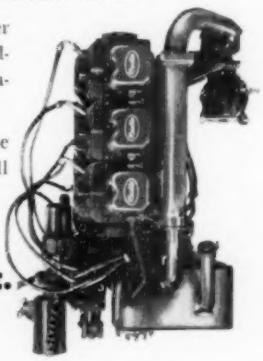

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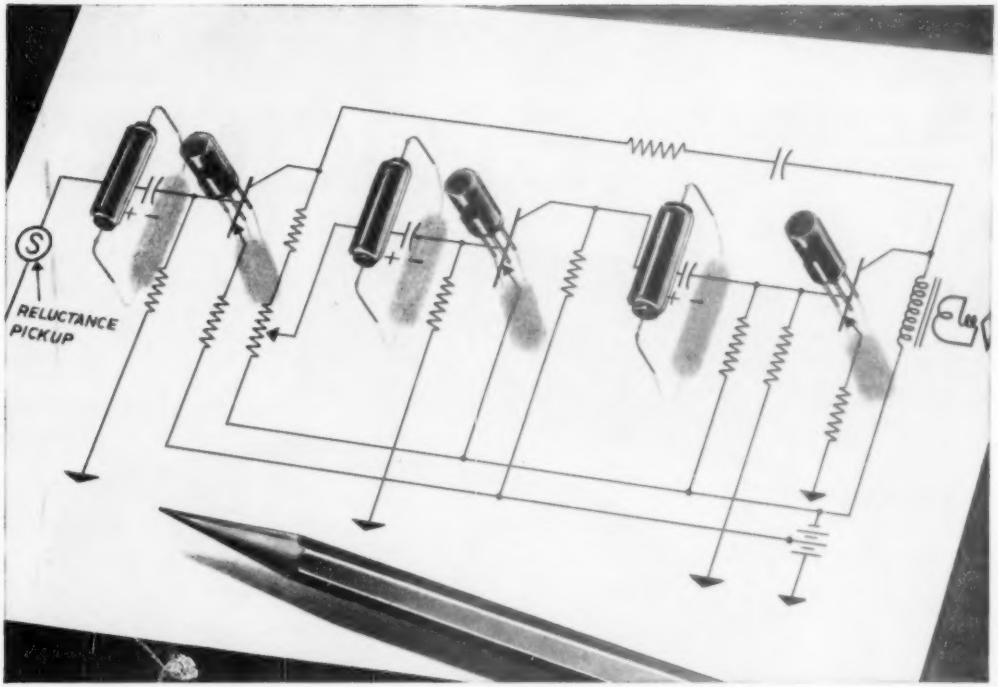

TRANSISTORS . . . TANTALYTIC CAPACITORS

teamed in 100-milliwatt tubeless amplifier

General Electric engineers at Electronics Park, Syracuse, have developed a new tubeless audio amplifier circuit that utilizes three junction transistors and three Tantalytic capacitors.

Although still experimental, this 3-stage amplifier promises significant advances in miniaturized equipments. It has a power output of 100 milliwatts—less than 10% distortion—and a power gain of 70 db.

Tantalytic capacitors were a "natural" for interstage coupling in the circuit because of their small size, large capacitance and low leakage current. They match the transistors in ruggedness and long operating life. And they will operate over a wide temperature range (−55°C to +85°C with at least 65% capacitance at −55°C). Other features include light weight, long shelf life, and hermetic sealing.

If you have a capacitor application where you need small size and superior performance, it will pay you to investigate Tantalytic capacitors. They're available in polar and non-polar construction and in ratings from 175 muf at 5 VDC to 12 muf at 150 VDC. For additional information use the convenient coupon below.

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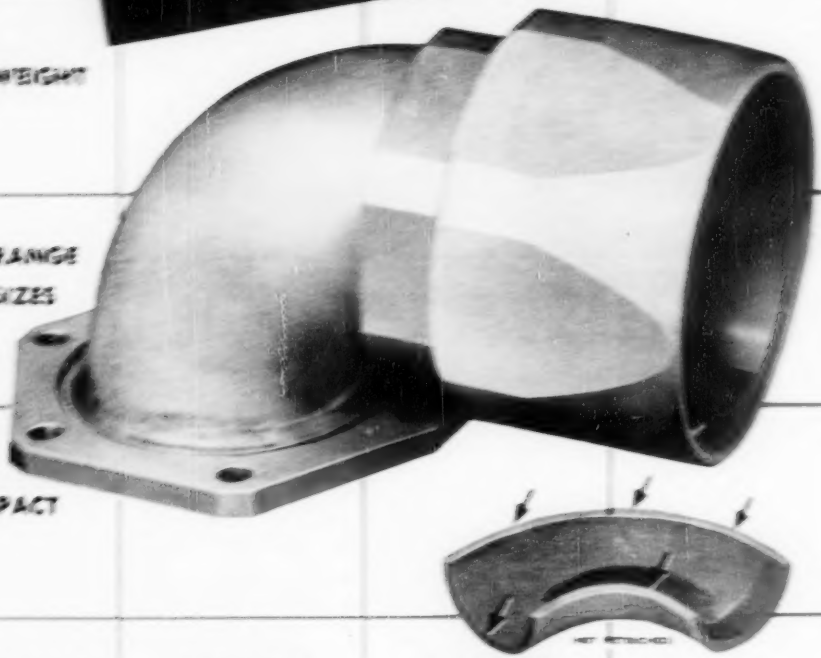

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Sperry Cutoff Monitors A-12 Autopilot

- **Irregular conditions bring unit into play.**
- **Tests over, device is in limited production.**

By Philip Klass

Sperry Gyroscope Co. has disclosed the inner workings of a device which will automatically disengage the A-12 autopilot in the event of a malfunction which would apply a sharp pitch-axis maneuver to the airplane.

The automatic cutoff has completed its prototype development and inflight service tests and is now in limited production.

▶ **What It Does**—The Sperry cutoff is designed to disengage the A-12 under either of two irregular conditions:

• **If the autopilot** suddenly develops an "uncalled-for" pitch-axis control signal; i.e., when the airplane is not pitching up or down.

• **If the airplane** starts to change its pitch attitude and the autopilot fails promptly to develop a counteracting control signal to re-level the airplane.

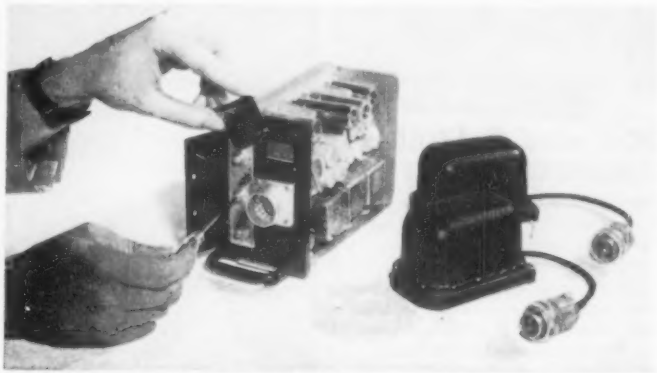
The airplane's pitch axis is considered by designers the most critical and will be the first to get cutoff protection. However, the devices developed both by Sperry and by Lear (AVIATION WEEK Sept. 1, p. 42) can be applied to all three airplane axes if desired.

▶ **The Need**—Although military aircraft have used autopilots without automatic cutoffs for years, some of the airlines feel the need for increased protection. Certain types of autopilot malfunctions can put a low-flying airplane into a dangerous attitude before the human pilot can manually disengage the autopilot. This has probably hindered airline acceptance of autopilot approach couplers for instrument landings.

Development of automatic cutoff, started at Sperry in 1945, was spurred by several airline accidents in recent years where the finger of suspicion pointed to the autopilot, although its guilt couldn't be proved.

▶ **Effectiveness Demonstrated**—Sperry gave this writer a graphic demonstration of the operation of the new cutoff, using an analog computer equipped with a highspeed recorder, which Sperry has set up to simulate a four-engine airliner.

Sperry normally limits the maximum servo output torque on an airliner installation so that the servo cannot deflect the elevator sufficiently to put more than a one-G incremental (additional to normal gravity) load on the plane. The servo used in the analog computer demonstration had no such arbitrary limit so that the simulated airliner pulled more Gs than could an actual airliner with limited servo output.



AUTOPILOT CUTOFF consists of amplifier (left), two small accelerometers (right).

With the cutoff disconnected, Sperry's Dr. George Arthur introduced a sudden (0.2 sec. rise time) autopilot malfunction. Within a second the recorder showed the airplane was pulling 1.8 incremental Gs and has nosed up almost 15 degrees. On an airliner, this could cause serious passenger injuries.

Dr. Arthur then connected the cutoff and introduced the same simulated fault. The cutoff disengaged the autopilot so quickly that the airplane pulled only 0.15 Gs and nosed up only 1¼ degrees.

▶ **Three Components**—The Sperry cutoff consists of three components:

• **A small amplifier** containing four vacuum tubes and two relays.

• **Two linear accelerometers**, so located and connected that they measure angular acceleration about the airplane's pitch axis. (One is located in the airplane's nose and the other in the tail; their output signal windings are connected in series-opposition to cancel out signals resulting from vertical accelerations of the airplane.)

▶ **How It Operates**—Because the Sperry cutoff uses accelerometers, there is a popular misconception that it won't disconnect the autopilot until the airplane has begun to "pull vertical Gs." This is not the case. The accelerometers provide essentially a "justification" signal used to determine whether the autopilot has good reason to apply a voltage to the servo motor.

The small amplifier continuously compares the autopilot-generated voltage applied to the servo motor with the voltage generated by the accelerometers. If either signal exists without a corresponding signal from the other, the amplifier "concludes" that something is wrong and instantly disengages the autopilot, except under conditions to be discussed later.

For example, suppose that the autopilot amplifier suddenly develops a signal which would cause the servo to apply up-elevator. The airplane should at that instant be pitching downward and the accelerometers should be generating a proportional "pitching down" signal. These two signals are compared within the cutoff amplifier. If they are equal and opposite (in polarity), they cancel, and the autopilot remains engaged; if not, the autopilot is instantly disengaged.

▶ **Usefulness in Turbulence**—The accelerometer signal is particularly useful during flight in turbulent air, according to P. Halpert, head of Sperry's flight control engineering department. Sperry is a proponent of "tight" autopilot control, which means applying sufficient and rapid corrective elevator motion to prevent any appreciable departure of the airplane from level flight.

In turbulent air, frequent applications of sizeable corrective signals may be necessary with a "tight" control autopilot. These can be safely applied. Hal-